Essential Skills - Numeracy Level 1 for Experienced Workers

ES LEVEL 1 RESOURCE FOR EXPERIENCED WORKERS - JULY 2010





Acknowledgements
We would like to thank CITB-ConstructionSkills Northern Ireland who had this resource published. We also acknowledge our colleagues in the construction departments of South Eastern Regional College and South West College for their advice in our research prior to preparing this resource. We have also benefited from the expertise of many friends within the industry.

Aims
This resource should be used in the context of appropriately planned and structured Essential Skills programmes and should be used and adapted appropriately within that context.

Guidance for Using Resource
It is not intended that these materials should be used as a fixed programme of learning but as a resource which tutors can use to aid them in the planning and delivery of programmes suited to the needs of their particular groups of learners.

It is envisaged that tutors will bring their own ideas to these materials and extend and enhance them in order to keep activities refreshed and dynamic for learners.

Essential Skills tutors should ensure that they read and understand the following publication before they develop programmes: ESSENTIAL SKILLS GOOD PRACTICE: THE ASSESSMENT PROCESS. DEL NI, July 2007.

All information on this page is current and up to date at the time of printing (July 2010).

Authors: Paula Philpott and William Smyth.

Essential Skills Numeracy for Experienced Workers

At Level 1 you will need to do a project on a subject you are interested in and you will take an exam at the end of your course.

This booklet will help you practice the skills you will need to achieve your level 1 in Numeracy.

When you see this symbol you may use a calculator to answer the question.

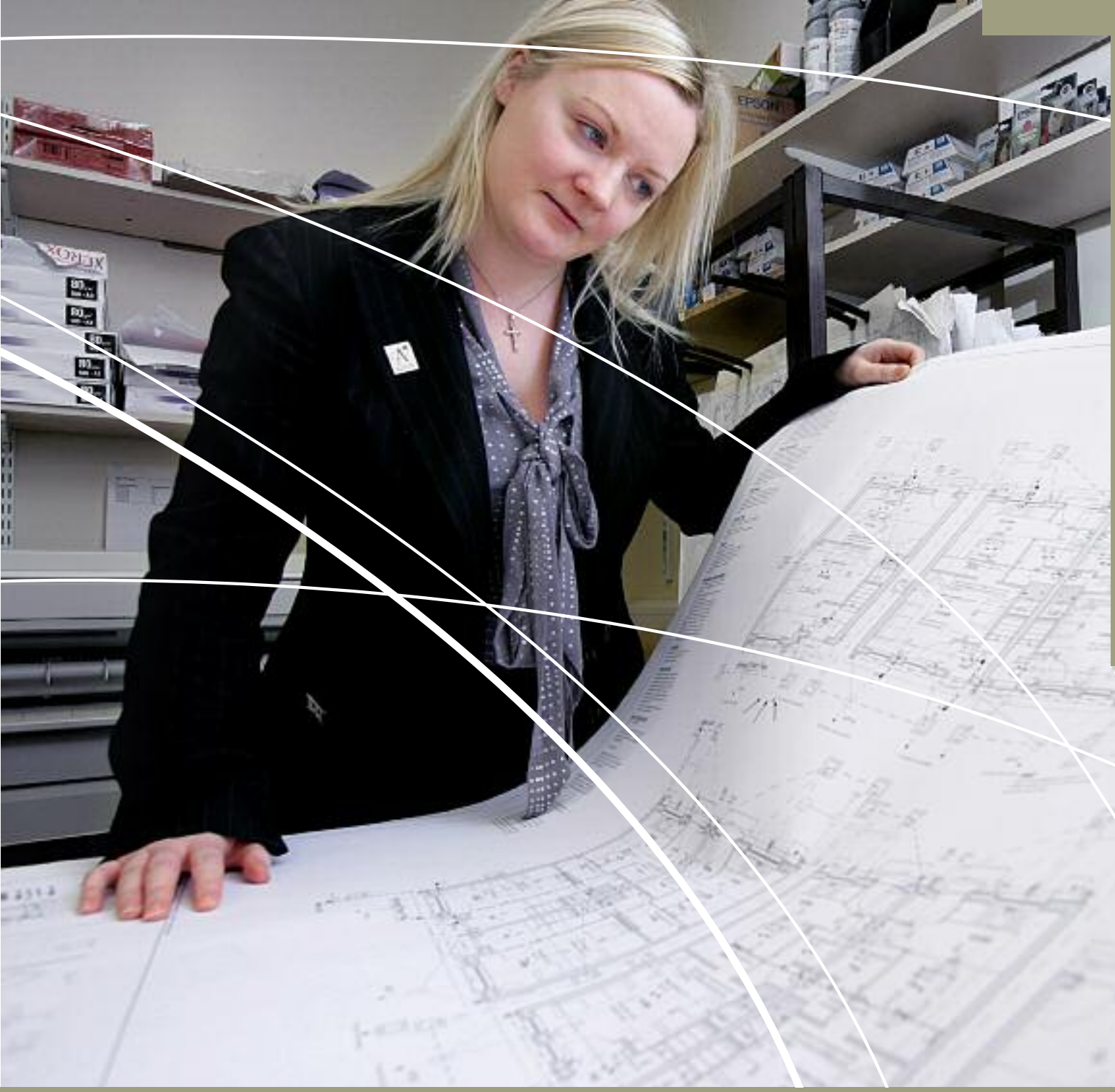
CONTENTS

NUMBER

MEASURE, SHAPE AND SPACE

HANDLING DATA

USEFUL WEBSITES



Number
Tasks and Answers

This section mainly addresses the curriculum area specified, although to allow a more realistic setting for each task, some elements from other curriculum areas may also be mentioned. Decimals are addressed in more detail through the section on measurement.





NUMBER TASK 1

PLACE VALUE

Below you will see figures for the construction industry. They are taken from NISRA – Northern Ireland Statistics and Research Agency. The statistics relate to local firms and their turnover. Look at the data and answer the questions below.

In the construction industry in Northern Ireland there are hundreds of thousands of people employed in different jobs and in your job you are required to work with large numbers, for example weights of material, costings for jobs, etc. Therefore it is important that you understand numbers and can work with them.

Structure of the Construction Industry (2008)

Turnover (£000) Size Band	Number of Firms	Per Cent of Total
0 – 99	4,430	40%
100 – 499	4,705	43%
500 – 1,999	1,345	12%
2,000 – 4,999	325	3%
5,000 – 9,999	115	1%
10,000 +	95	1%
Total	**11,015**	**100%**

Source: NISRA – NI Construction Bulletin 1st April to 30th June (Nov 2008)

From the table above you can see that there were 11,015 construction firms in Northern Ireland at the time of the survey.

The number 11 015 has:

TEN THOUSAND	THOUSAND	HUNDREDS	TEN	UNITS
1	1	0	1	5

When reading large numbers break them into groups of three (starting at the units end). Sometimes these groups of three digits are separated using commas.

NUMBER TASK 1

1. Complete the table below the first one is completed for you.

	Millions	Hundred thousands	Ten thousand	Thousand	Hundred	Tens	Units	
2 303 105	2	3	0	3	1	0	5	**Two million, three hundred and three thousand, one hundred and five**
32 015								
								One hundred and six thousand and forty five
			3	0	2	1	0	
	1	0	0	0	0	2	5	
19 206								
								Forty five thousand and twelve

NUMBER TASK 1

2. Using the table below answer the questions

Turnover (£000) Size Band	Number of Firms	Per Cent of Total
0 – 99	4,430	40%
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500 – 1,999	1,345	12%
2,000 – 4,999	325	3%
5,000 – 9,999	115	1%
10,000 +	95	1%
Total	**11,015**	**100%**

Source: NISRA – NI Construction Bulletin 1st April to 30th June (Nov 2008)

a. 4,430 firms had a turnover from £0-£99,000. How many firms is this in words?

b. What is the turnover of £99,000 in words?

c. Most construction firms in Northern Ireland have a turnover between £100,000 and £499,000. What is this in words?

£100,000

£499,000

3. What do the figures in the table tell you about the construction industry in Northern Ireland?

NUMBER TASK 2

ADDITION AND SUBTRACTION

When costing up a job you need to be able to add, subtract, multiply and divide. You have to be able to find a rough estimate and then provide a detailed breakdown of all costs including taxes. If you have others working for you this will mean calculating their wages and keeping accurate records of turnover.

When ordering in materials you need to ensure that the quantities have been correctly calculated.

Addition
If the numbers are too big to add in your head, write them down in columns. Separate the numbers into units, tens, hundreds and thousands. Always start adding with the units first.

Example
3256 + 275

Start at the unit column first. If the total is more than 10, carry 1 to the next column.

Th	H	T	U
3	2	5	6
	2	7_1	5
3	5	3	1

Structure of the Construction Industry (2008)

Turnover (£000) Size Band	Number of Firms	Per Cent of Total
0 – 99	4,430	40%
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10,000 +	95	1%
Total	**11,015**	**100%**

Source: NISRA – NI Construction Bulletin 1st April to 30th June (Nov 2008)

1. From the table above what is the total number of construction firms with a turnover under £500,000?

2. How many firms have a turnover of £2,000,000 or more?

NUMBER TASK 2

Subtraction
Again line up the numbers so that you subtract units from units, tens from tens etc... Always start subtracting with the units first.

Th	H	T	U
2	5	6	7
1	4	2	5
1	1	4	2

There are different methods you can use to subtract. Look at the examples below and use the method that is most familiar to you.

Example 1
Start with the units

Start at the unit column first. If the total is more than 10, carry 1 to the next column.

Th	H	T	U
$^{1}2$	$^{1}5$	6	7
1	9	2	7
	6	4	0

Example 2
Start with the units

You cannot subtract 9 from 5. You will need to borrow 1 from the thousands column to make 15 and pay this back by adding 1 to the thousands column of the number you are subtracting. It becomes 2.

Th	H	T	U
2	$^{1}5$	6	7
$_{1}2$	9	2	7
	6	4	0

NUMBER TASK 2

Use whichever method is most familiar to you to answer these questions.

3. A construction company employs 111 men and 27 women. How many more men than women does it employ?

4. A high visibility jacket costs £17.05 and £13.67 from two different suppliers. What is the difference in price?

NUMBER TASK 3

PAY

In the last task we saw how important it is that you can accurately add and subtract.

James works for McLaughlin Builders below and has received his latest payslip. He is worried that the pay is incorrect. Look at the payslip below and answer the questions given.

James is a site manager for a manufacturing firm. His last payslip was:

McLAUGHLIN BUILDERS
Randalstown

Employee name: James Greeves

Employee Number: 25

Pay date: 31/5/09

Payments	
Basic pay	£3026.25

Tax code	01 2010
Tax code	355 L
NI Number	NR674590A
NI Code	D

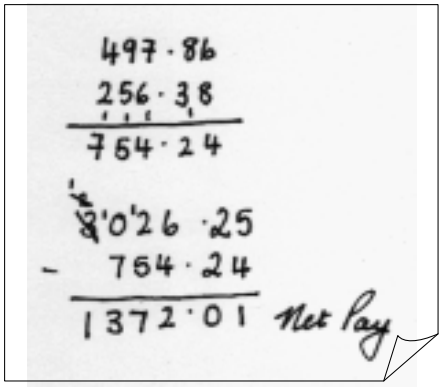
Deductions	
Tax paid	£497.86
Employee's NI Paid	£256.38

NET PAY: ?????

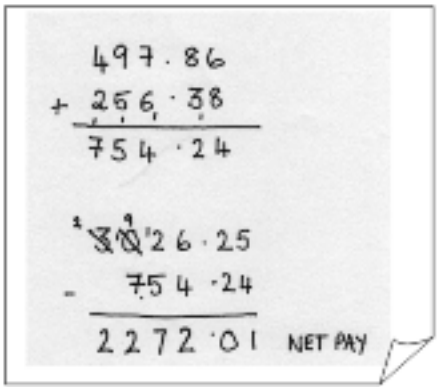
NUMBER TASK 3

James has been checking his pay and thinks that it has been incorrectly calculated. He thinks his net pay (the remaining amount of an employee's gross pay after deductions such as income tax and national insurance are made) should be £1,372.01. His brother Jason and his wife Amy also check to see what they calculate his net pay should be. Their calculations are shown below:

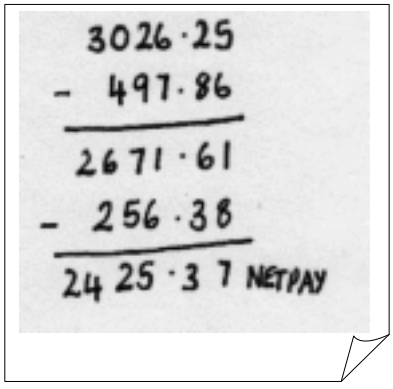
James



Jason



Amy



Look at the calculations they have made.

- Who do you think has calculated the net pay correctly and why?
- Who has calculated it incorrectly and what mistake/s did they make?

Fill your answers in the table below:

	Delete as appropriate	**Reason** (e.g. what mistake did they make)
James	Correct / incorrect	
Jason	Correct / incorrect	
Amy	Correct / incorrect	

NUMBER TASK 4

MULTIPLICATION AND DIVISION

When ordering materials for McLaughlin Builders, James has been double checking his calculations to make sure he orders in the correct quantities. He needs to be able to multiply and divide numbers accurately. The methods used are shown below.

You will need to know your multiplication tables to help you work out multiplication and division problems.

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

NUMBER TASK 4

Multiplication

Example 2
Start with the units

	4	**8**
x	4	**6**
2	**8**	**8**

Start with the units. 8 x 6 + 48. Put 8 in the units column and carry the 4. When you multiply the tens column 4 x 6 = 24, don't forget to add the 4 you carried to get 24 + 4 + 28.

1. If you need to buy two pairs of safety boots at £29.92, how much will the total cost be?

Estimate your answer first. £29.92 is approximately £30. 2 pairs of boots at £30 would cost £60. Now calculate the actual cost and see if your answer seems reasonable.

Example
A 1kg box of galvanised nails costs £2.43. You need to buy 12 boxes. How much will this come to?

	2	**.**	**4**	**3**
×			**1**	**2**
	4	**.**	8	6
+ 2	41	**.**	3	0
2	**9**	**.**	**1**	**6**

Start by multiplying by the 2.
3 x 2 + 6, then 4 x 2 = 8, then 2 x 2 = 4
This gives the first row of the table.

Next you will multiply the one in the tens column. Put 0 in the units column because you are multiplying tens. Then multiply by 1.

Add them together 4.86 + 24.30 to get £29.16

2. If a site joiner earns £9.25 an hour. How much does he earn for 11 hours work?

NUMBER TASK 4

Division

If the numbers are too difficult to divide in your head, use a written method. The example below shows you how.

Example
Hard hats cost £9.69 for three. How much does one cost?

- Divide the 9 by the 3 first to get 3. Write this above the 9.
- Divide the 6 by the 3 next to get 2. Write this above the 6.
- Divide the second 9 by the 3 next to get 3. Write this above the second 9.

$$\begin{array}{r|l} & \mathbf{3.23} \\ \hline \mathbf{3} & \mathbf{£9.69} \end{array}$$

A hard hat will cost £3.23.

3. A length of wood measuring 2450mm, is cut into 5 equal lengths. How long is each piece of wood?

4. A bill of £1840 is paid in 8 equal payments. How much is each payment?

NUMBER TASK 5

BUYING A VAN

John is a self-employed plasterer and has decided he needs to change his work van. His local commercial vehicle dealer has the following options available to suit his budget. Read through the information given and help John make up his mind regarding a new work van.

Make/Model/Year	Price (£)		Mileage
	Straight Deal	Trade-in	
2007 Ford Transit	7595	8295	12635
2008 Renault Master	7825	8195	31506
2006 Peugeot Boxer	4995	5295	24382
2009 Iveco Daily	9475	9995	1465
2006 Mercedes Sprinter	6995	7295	31056

1. Arrange the list of vans above in order of increasing Straight Deal price.

Van	Price

2. Arrange the list of vans in order of decreasing mileage.

Van	Mileage

After some consideration John decides to trade in his current van against the 2008 Renault Master. The dealer offers him £1250 for his old Nissan van.

NUMBER TASK 5

3. Complete the cheque below with the balance John needs to pay.

John later decides to take advantage of an offer of extended warranty which includes free servicing. This is available at a cost of 5% of the Straight Deal price of the Renault van. Calculate the new total he must pay and complete the cheque below giving your answer to the nearest pound. You are given some steps involved in the calculation to help you.

4. What is 10% of the Straight Deal price in pounds and pence?

5. What is 5% of the Straight deal price in pounds and pence?
Use the answer above to help you.

NUMBER TASK 5

6. Round this amount to the nearest pound.

7. Now calculate the new total amount he must pay for the van and the extended warranty and complete the cheque below.

NUMBER TASK 6

JOBS IN CONSTRUCTION

There are various jobs associated with the construction industry from trades such as plasterers, site joiners to site foremen, architects etc. Have a look at the jobs being advertised below and the salaries associated with them.

Job A: Plasterer

Job Summary

Company	MDL
Location	Belfast
Industries	Construction - Residential & Commercial/Office
Job Type	Full Time Temporary/Contract/Project
Career Level	Experienced (Non-Manager)
Salary	13.00 GBP per hour + business mileage

1. The company offer to pay time and a half for any evening work you do. What would the hourly rate be for overtime?

2. If you work 40 hours a week at the standard rate, what will your weekly salary be?

NUMBER TASK 6

3. If you work 40 hours at the standard rate and 5 hours at the overtime rate – how much will you earn?

Job B: Qualified bricklayer

Bricklayer - (Full-time / Temporary)

Job reference: 882431
Date notified: 29/06/2009
Job location: Ballymena
Salary: £8.50 per hour
Hours: 40
Worktime: 8.00am - 5.00pm
Age: 16 and over
Closing date: 03/07/2009
Pension type: Prefer Not to Say

4. What will the weekly salary be?

NUMBER TASK 6

5. Remembering that there are 52 weeks in a year, what is the annual salary?

6. If you got Job A what would your annual salary be for a 40 hour week for 52 weeks? (Use your answer to question 2 where you worked out the weekly salary.)

7. How much more would you earn in Job A than Job B per year?

NUMBER TASK 6

Job C: Site Foreman

HAYS

Hays Specialist Recruitment
9th Floor 14 Great Victoria Street Belfast BT 2 7BA
Tel: See Below www: www.Hays.com/NI
Fax: See Below Email See Below

Ref no:	NJ-44108
Title:	Civil Works Foreman (Belfast)
Date last updated by recruiter:	13 Aug 2009
Location:	Antrim,Belfast,Down
Job type:	Temporary Full-time
Salary:	£25000 - £35000
Additional benefits:	See Description
Role(s) That best describe this job	Foreperson - construction Site manager Site Agent
Qualifications:	See Description
Contact:	Oliver Smith

APPLY

8. What is the range in the salary for this job?

NUMBER TASK 6

9. The successful candidate for this post was given a salary of £27,300. How much does this work out at per month?

Monthly salary =

10. For the annual salary of £27,300 how much will the successful candidate earn per week? Remember there are 52 weeks in a year.

11. If the successful candidate is offered a 10% pay rise at the end of the first year, how much will their annual salary be?

To find 10 % of the salary, divide the total salary by 10.

10 % pay rise =

Annual salary =

NUMBER TASK 7

CALCULATIONS

You are employed by a large construction company and are nearing completion of a private development of 8 houses. One of the new owners has requested a decked area be constructed to the rear of his premises adjacent to the garden. As this was not part of the original job specification you need to calculate the cost of this separately. It is important to be able to take account of materials requirements as well as labour and taxes where appropriate. Use the information given to answer the questions below to help you price this additional work.

Decking

EXAMPLE: To calculate how much decking you need for deck measuring 4mx3m use the table below: Table showing the number of metres of 144mm deck boards required

METRES	1	2	3	4	5	6
1	7	14	21	28	35	42
2	14	28	42	56	70	84
3	21	42	63	84	105	126
4	28	56	**84**	112	140	168
5	35	70	105	140	175	210
6	42	84	126	168	210	252

From the table above you can see that a deck measuring 4mx3m you will need 84m of 144mm wide deck board.

If the deck boards you want come in 2.4m lengths, divide 84 by 2.4 = 35. You should buy 35 boards.

The cost of each length of board from the local supplier's website is shown below.

To calculate the total cost of the decking boards using a calculator, the sum is:

35 × £4.46 =

NUMBER TASK 7

1. The answer on the screen is: 156.1. What does this mean the total cost of the decking is?

2. Using the table below find the number of metres of deck board needed for a decked area measuring 5m by 6m.

Table showing the number of metres of 144mm deck boards required

METRES	1	2	3	4	5	6
1	7	14	21	28	35	42
2	14	28	42	56	70	84
3	21	42	63	84	105	126
4	28	56	84	112	140	168
5	35	70	105	140	175	210
6	42	84	126	168	210	252

Number of metres of deck board required is.....

Compare

Reversible Treated Deck Board Smooth/Grooved Green Treated (L)2400 x (W) 144 x (T)28mm

EAN: 5022652800611

in store

Available for reserve & collect

Select a store to check stock & reserve & collect

home delivery

Not available

Only £4.46

Qty: 1

add to shopping list

NUMBER TASK 7

3. The deck boards you want come in 2.4m lengths. How many lengths of deck board will you need?

Be careful how you round your answer.

4. If each length of deck board costs £4.46, what is the total cost of the deck board?

Total cost

NUMBER TASK 7

Paul is on his way home after a job. He is already thinking of work tomorrow and about getting tiles. He worked out earlier he needs just under 600 tiles for the next job. A slight detour on the way home would take him past the tile warehouse but as he has no trailer with him he could only fit one pallet in the van. If he needs more than one pallet he will leave it until tomorrow when he could call back with the trailer. It would save quite a bit of time if he could get the tiles today.

He knows from experience that the tiles he needs come in boxes with 4 tiles per box and that the boxes are stacked on the pallet in layers. Each layer has 5 by 6 boxes and there are 6 layers altogether. Paul is trying to work out in his head if this amounts to more than 600 tiles. He knows the calculation he needs to do is 4 x 5 x 6 x 6.

5. Can you think of a way to answer his question without having to do the calculation in full?

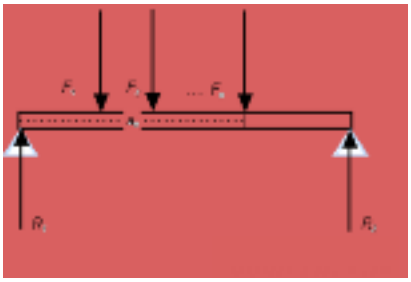
Is 4 x 5 x 6 x 6 more than 600?

Will he call for the tiles on his way home? Please explain your reasoning

NUMBER TASK 8

NEGATIVE NUMBERS

Negative numbers are numbers to the left (or below) zero on a number line. The use of negative numbers in construction is generally related to temperature, finances, height above/below sea level in surveying, direction of rotation e.g., clockwise or anticlockwise or the direction of forces that act in beams, columns, frames etc. You need to be able work with negative numbers accurately.



We will consider two construction related uses of negative numbers here; temperature and finances (bank statement).

In the Celsius temperature scale 0°C represents the freezing point of water. Be careful, it does not mean there is no heat energy present. It just means there isn't enough heat present for water to exist in liquid form so it freezes. A negative value on the Celsius scale indicates a temperature lower than 0°C where there is less heat energy present and so it feels colder.

1. In the space below construct a temperature scale (a number line) that extends from -5°C to 5°C in steps on 1°C. Use your ruler and work to a scale of 1cm for 1°C. Mark the temperatures -4°C and 2°C

NUMBER TASK 8

2. In the space below identify the temperatures marked on the scale.

3. If the answers above referred to external temperatures on a cold evening indicate which one is most likely to result in burst water pipes in a building if the heating was off.

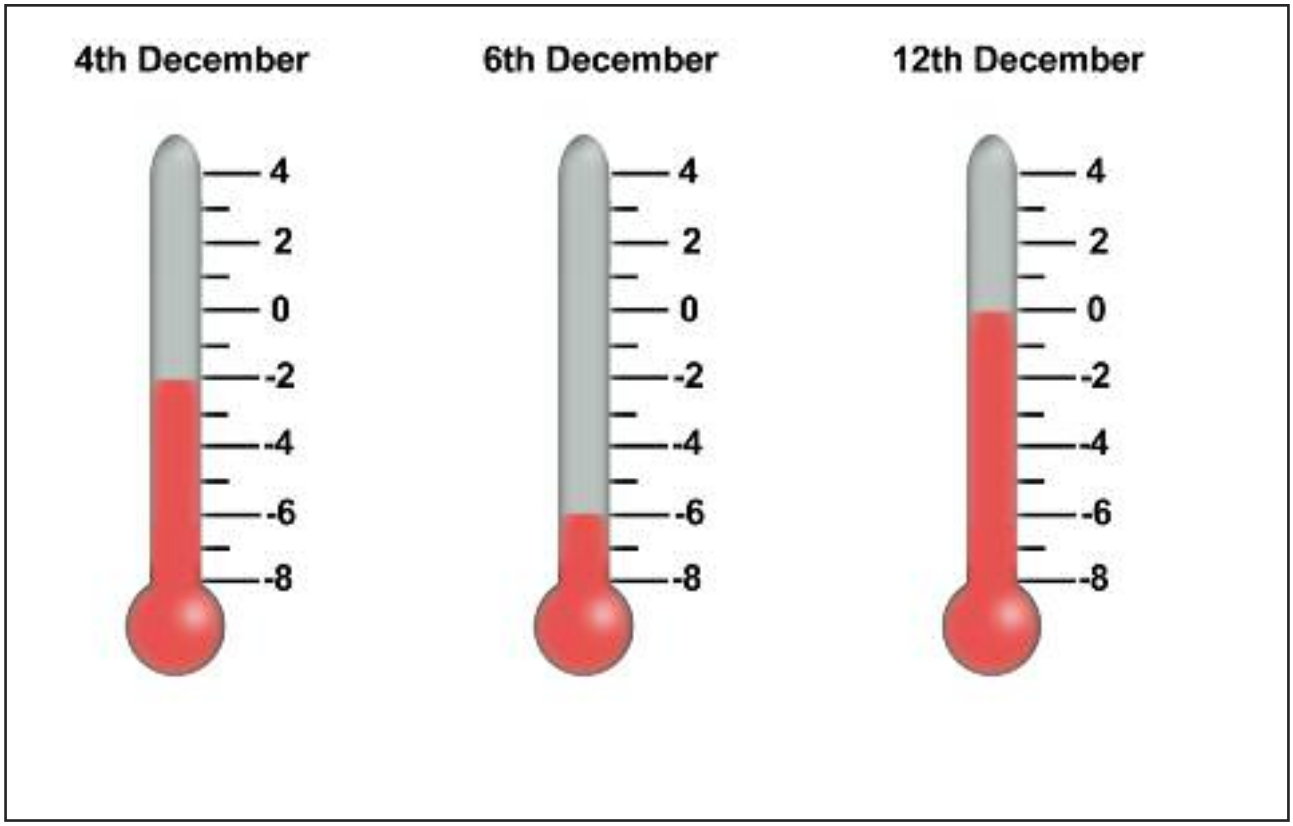
NUMBER TASK 8

Ambient temperature is very important when laying asphalt. According to relevant British Standards the asphalt itself should be at 85° C but the ambient temperature should be no less than -3°C.

Janine has been checking temperatures over a period of two weeks and here are her results.

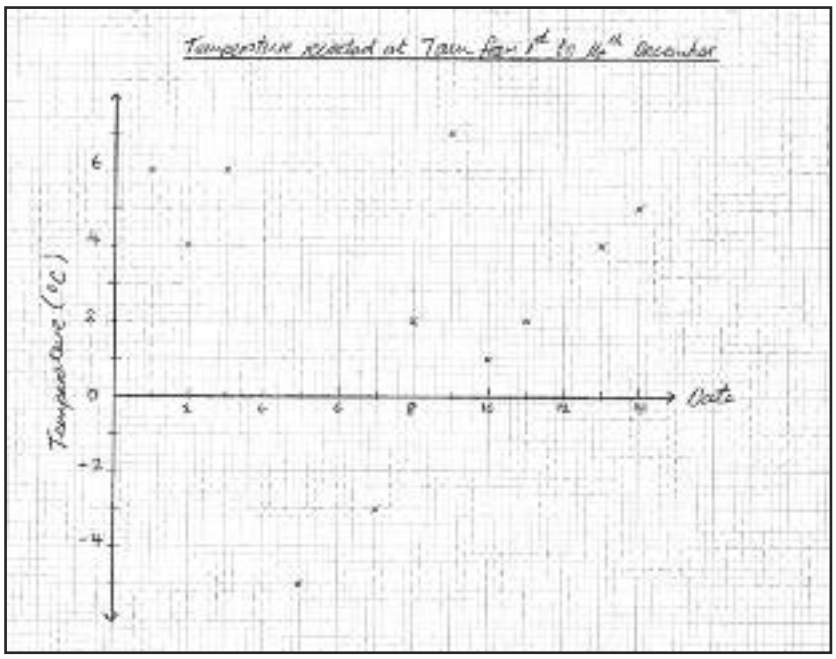
December	Temperature (°C)													
Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Temp	6	4	6		-5		-3	2	7	1	2		4	5

4. Values for 4th, 6th and 12th December are not shown in the table. The images below show the temperatures for these dates. Make each temperature reading and record the result in the table.



NUMBER TASK 8

5. Using the graph below plot the remaining points. Join the points using a straight edge to produce a line graph showing how the temperature varied over the two-week period.



6. What was the highest temperature recorded and on which date did this occur?

Highest temperature:

Date:

7. What was the lowest temperature recorded and on which date did this occur?

Lowest temperature:

Date:

NUMBER TASK 8

8. What is the range of temperature during the second week in December?

9. On 4th December the temperature was -2°C. By the next day it had fallen to –5°C. Use the image below to work out by how many degrees the temperature changed?

NUMBER TASK 8

Janine wants to work out the average temperature in the second week of December. To calculate the mean she has to add up all the temperatures for that week and divide the total by 7.

10. Janine's answer is 3.5°C. Her colleague Brendan says that the answer should be 3°C. Who is correct?

Show how you calculated your answer in the space below.

Write the sum of the temperatures here, Total =

Mean temperature = Total ÷ 7 =

Who is correct?

11. On how many days during the two-week period could asphalt not have been laid?

NUMBER TASK 9

FINANCE

Below is a bank statement for a construction engineering consultancy for the month of April 2009. The consultant wants to check the figures in the statement and this means he will need to look at withdrawals and lodgements on the account. He wants to know whether his account is in credit or debit and if the bank's calculations are correct.

Northern Regional Bank
Nicer Branch
Broad St
Lisburn
Co Antrim
Tel: 02890909090

Statement of Account
Sort: 09-59-01
A/C 555362744
Date 12.04.09

FE Dylan
18 Mull Rd
Ballinderry
Lisburn

Date	Details	Debits	Credits	Balance
01 Apr	Opening Balance			996.87
03 Apr	Standing order 001	288.44		
04 Apr	Cheque 234016	174.45		
08 Apr	Cash paid in		372.00	
09 Apr	Cheque 234017	277.30		
11 Apr	Cheques paid in		540.50	
15 Apr	Standing order 002	569.45		
16 Apr	Cash paid in		340.18	
21 Apr	Cheques for salary	840.37		
23 Apr	Cash paid in		540.34	
26 Apr	Cheque paid in		2277.45	
29 Apr	Cash paid in		2480.32	
30 Apr	Closing Balance			

NUMBER TASK 9

1. Fill in the balance column as far as 29th April. The balance on 29th April should be £5397.65, allowing you to check your answer. Use the space below as well if you need to.

2. On which day was the account at its lowest point and how much did he have in the bank on that date?

Date:

Balance:

3. A cheque of £6000 for salaries is withdrawn from the account on 30th April taking the account to -£639.31. What does the negative sign mean?

NUMBER ANSWERS - TASK 1

PLACE VALUE

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NUMBER ANSWERS - TASK 1

1. Complete the table below the first one is completed for you.

	Millions	Hundred thousands	Ten thousand	Thousand	Hundred	Tens	Units	
2 303 105	2	3	0	3	1	0	5	Two million, three hundred and three thousand, one hundred and five
32 015			3	2	0	1	5	Thirty two thousand and fifteen
106 045		1	0	6	0	4	5	One hundred and six thousand and forty five
30 210			3	0	2	1	0	Thirty thousand two hundred and ten
1 000 025	1	0	0	0	0	2	5	One million and twenty five
19 206			1	9	2	0	6	Nineteen thousand, two hundred and six
45 012			4	5	0	1	2	Forty five thousand and twelve

NUMBER ANSWERS - TASK 1

2. Using the table below answer the questions

Turnover (£000) Size Band	Number of Firms	Per Cent of Total
0 – 99	4,430	40%
100 – 499	4,705	43%
500 – 1,999	1,345	12%
2,000 – 4,999	325	3%
5,000 – 9,999	115	1%
10,000 +	95	1%
Total	**11,015**	**100%**

Source: NISRA – NI Construction Bulletin 1st April to 30th June (Nov 2008)

a. 4,430 firms had a turnover from £0-£99,000. How many firms is this in words?

Four thousand four hundred and thirty

b. What is the turnover of £99,000 in words?

Ninety nine thousand pounds

c. Most construction firms in Northern Ireland have a turnover between £100,000 and £499,000. What is this in words?

£100,000 One hundred thousand pounds

£499,000 Four hundred and ninety nine thousand pounds

3. What do the figures in the table tell you about the construction industry in Northern Ireland?

Most construction companies in Northern Ireland have a small turnover.

NUMBER ANSWERS - TASK 2

ADDITION AND SUBTRACTION

When costing up a job you need to be able to add, subtract, multiply and divide. You have to be able to find a rough estimate and then provide a detailed breakdown of all costs including taxes. If you have others working for you this will mean calculating their wages and keeping accurate records of turnover.

When ordering in materials you need to ensure that the quantities have been correctly calculated.

Addition
If the numbers are too big to add in your head, write them down in columns. Separate the numbers into units, tens, hundreds and thousands. Always start adding with the units first.

Example
3256 + 275

Start at the unit column first. If the total is more than 10, carry 1 to the next column.

Th	H	T	U
3	2	5	6
	2	7_1	5
3	5	3	1

Structure of the Construction Industry (2008)

Turnover (£000) Size Band	Number of Firms	Per Cent of Total
0 – 99	4,430	40%
100 – 499	4,705	43%
500 – 1,999	1,345	12%
2,000 – 4,999	325	3%
5,000 – 9,999	115	1%
10,000 +	95	1%
Total	**11,015**	**100%**

Source: NISRA – NI Construction Bulletin 1st April to 30th June (Nov 2008)

1. From the table above what is the total number of construction firms with a turnover under £500,000?

4430+4705 = 9135

2. How many firms have a turnover of £2,000,000 or more?

325+115+95 = 535

NUMBER ANSWERS - TASK 2

Subtraction
Again line up the numbers so that you subtract units from units, tens from tens etc... Always start subtracting with the units first.

Th	H	T	U
2	5	6	7
1	4	2	5
1	1	4	2

There are different methods you can use to subtract. Look at the examples below and use the method that is most familiar to you.

Example 1
Start with the units

Start at the unit column first. If the total is more than 10, carry 1 to the next column.

Th	H	T	U
$^{1}2$	$^{1}5$	6	7
1	9	2	7
	6	4	0

Example 2
Start with the units

You cannot subtract 9 from 5. You will need to borrow 1 from the thousands column to make 15 and pay this back by adding 1 to the thousands column of the number you are subtracting. It becomes 2.

Th	H	T	U
2	$^{1}5$	6	7
$_{1}2$	9	2	7
	6	4	0

NUMBER ANSWERS - TASK 2

Use whichever method is most familiar to you to answer these questions.

3. A construction company employs 111 men and 27 women. How many more men than women does it employ?

111-27 = 84

4. A high visibility jacket costs £17.05 and £13.67 from two different suppliers. What is the difference in price?

£17.05 - £13.67 = £3.38

NUMBER ANSWERS - TASK 3

PAY

In the last task we saw how important it is that you can accurately add and subtract.

James works for McLaughlin Builders below and has received his latest payslip. He is worried that the pay is incorrect. Look at the payslip below and answer the questions given.

James is a site manager for a manufacturing firm. His last payslip was:

McLaughlin Builders
Randalstown

Employee name: James Greeves

Employee Number: 25

Pay date: 31/5/09

Payments	
Basic pay	£3026.25

Tax code	01 2010
Tax code	355 L
NI Number	NR674590A
NI Code	D

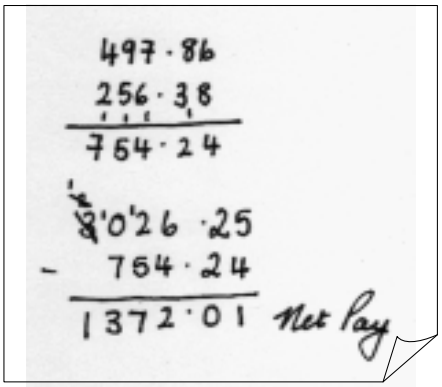
Deductions	
Tax paid	£497.86
Employee's NI Paid	£256.38

NET PAY: ?????

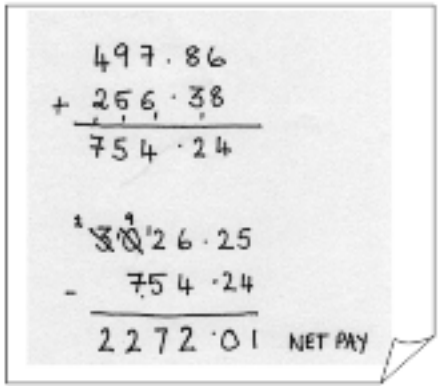
NUMBER ANSWERS - TASK 3

James has been checking his pay and thinks that it has been incorrectly calculated. He thinks his net pay (the remaining amount of an employee's gross pay after deductions such as income tax and national insurance are made) should be £1,372.01. His brother Jason and his wife Amy also check to see what they calculate his net pay should be. Their calculations are shown below:

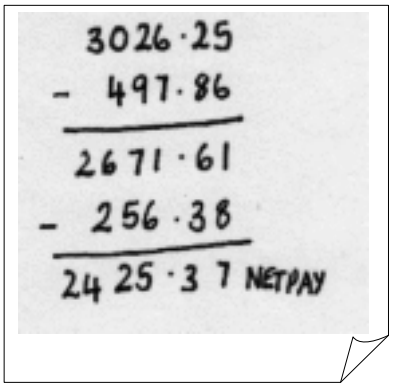
James



Jason



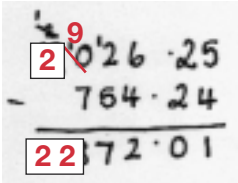
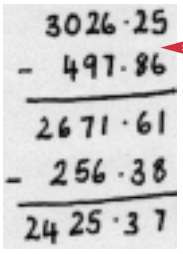
Amy



Look at the calculations they have made.

- Who do you think has calculated the net pay correctly and why?
- Who has calculated it incorrectly and what mistake/s did they make?

Fill your answers in the table below:

	Delete as appropriate	**Reason** (e.g. what mistake did they make)
James	Correct / **incorrect**	James has added the deductions together correctly but he made a mistake when he subtracted this from the gross pay. 
Jason	**Correct** / incorrect	Jason added the deductions together corrected and subtracted this total correctly from the gross pay.
Amy	Correct / **incorrect**	Amy subtracts incorrectly – she simply takes the smallest digit from the largest in each column.  Here she starts off taking 5 from 6 instead of realising it is 5-6 and then borrowing from the tens column and continues with this method throughout.

NUMBER ANSWERS - TASK 4

MULTIPLICATION AND DIVISION

When ordering materials for McLaughlin Builders, James has been double checking his calculations to make sure he orders in the correct quantities. He needs to be able to multiply and divide numbers accurately. The methods used are shown below.

You will need to know your multiplication tables to help you work out multiplication and division problems.

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

NUMBER ANSWERS - TASK 4

Multiplication

Example 2
Start with the units

	4	**8**
x	4	**6**
2	**8**	**8**

Start with the units. 8 x 6 + 48. Put 8 in the units column and carry the 4. When you multiply the tens column 4 x 6 = 24, don't forget to add the 4 you carried to get 24 + 4 + 28.

1. If you need to buy two pairs of safety boots at £29.92, how much will the total cost be?

Estimate your answer first. £29.92 is approximately £30. 2 pairs of boots at £30 would cost £60. Now calculate the actual cost and see if your answer seems reasonable.

£29.92 × 2 = 59.84

Example
A 1kg box of galvanised nails costs £2.43. You need to buy 12 boxes. How much will this come to?

	2	**.**	**4**	**3**
×			**1**	**2**
	4	**.**	8	6
+ 2	4_1	**.**	3	0
2	**9**	**.**	**1**	**6**

Start by multiplying by the 2.
3 x 2 + 6, then 4 x 2 = 8, then 2 x 2 = 4
This gives the first row of the table.

Next you will multiply the one in the tens column. Put 0 in the units column because you are multiplying tens. Then multiply by 1.

Add them together 4.86 + 24.30 to get £29.16

2. If a site joiner earns £9.25 an hour. How much does he earn for 11 hours work?

£9.25 × 11 = £101.75

NUMBER ANSWERS - TASK 4

Division

If the numbers are too difficult to divide in your head, use a written method. The example below shows you how.

Example
Hard hats cost £9.69 for three. How much does one cost?

- Divide the 9 by the 3 first to get 3. Write this above the 9.
- Divide the 6 by the 3 next to get 2. Write this above the 6.
- Divide the second 9 by the 3 next to get 3. Write this above the second 9.

$$\begin{array}{r} 3.23 \\ 3 \overline{)\ £9.69} \end{array}$$

A hard hat will cost £3.23.

3. A length of wood measuring 2450mm, is cut into 5 equal lengths. How long is each piece of wood?

2450 ÷ 5 = 490mm

4. A bill of £1840 is paid in 8 equal payments. How much is each payment?

£1840 ÷ 8 = £230

NUMBER ANSWERS - TASK 5

BUYING A VAN

John is a self-employed plasterer and has decided he needs to change his work van. His local commercial vehicle dealer has the following options available to suit his budget. Read through the information given and help John make up his mind regarding a new work van.

Make/Model/Year	Price (£)		Mileage
	Straight Deal	Trade-in	
2007 Ford Transit	7595	8295	12635
2008 Renault Master	7825	8195	31506
2006 Peugeot Boxer	4995	5295	24382
2009 Iveco Daily	9475	9995	1465
2006 Mercedes Sprinter	6995	7295	31056

1. Arrange the list of vans above in order of increasing Straight Deal price.

Van	Price
2006 Peugeot Boxer	4995
2006 Mercedes Sprinter	6995
2007 Ford Transit	7595
2008 Renault Master	7825
2009 Iveco Daily	9475

2. Arrange the list of vans in order of decreasing mileage.

Van	Price
2008 Renault Master	31506
2006 Mercedes Sprinter	31056
2006 Peugeot Boxer	24382
2007 Ford Transit	12635
2009 Iveco Daily	1465

After some consideration John decides to trade in his current van against the 2008 Renault Master. The dealer offers him £1250 for his old Nissan van.

NUMBER ANSWERS - TASK 5

3. Complete the cheque below with the balance John needs to pay.

John later decides to take advantage of an offer of extended warranty which includes free servicing. This is available at a cost of 5% of the Straight Deal price of the Renault van. Calculate the new total he must pay and complete the cheque below giving your answer to the nearest pound. You are given some steps involved in the calculation to help you.

4. What is 10% of the Straight Deal price in pounds and pence?

10% of £7825 = £782.50

5. What is 5% of the Straight deal price in pounds and pence?
Use the answer above to help you.

5% is half of 10%

half of £782.50 is £391.25

NUMBER ANSWERS - TASK 5

6. Round this amount to the nearest pound.

£391

7. Now calculate the new total amount he must pay for the van and the extended warranty and complete the cheque below.

£6945 + £391 = £7336

NUMBER ANSWERS - TASK 6

JOBS IN CONSTRUCTION

There are various jobs associated with the construction industry from trades such as plasterers, site joiners to site foremen, architects etc. Have a look at the jobs being advertised below and the salaries associated with them.

Job A: Plasterer

Job Summary

Company	MDL
Location	Belfast
Industries	Construction - Residential & Commercial/Office
Job Type	Full Time Temporary/Contract/Project
Career Level	Experienced (Non-Manager)
Salary	13.00 GBP per hour + business mileage

1. The company offer to pay time and a half for any evening work you do. What would the hourly rate be for overtime?

£13 + ½ of £13

½ of £13 = £13.00 ÷ 2 = £6.50

£13 + £6.50 = £19.50

2. If you work 40 hours a week at the standard rate, what will your weekly salary be?

£13 × 40 = £13 ×10 × 4 = £130 × 4 = £520

NUMBER ANSWERS - TASK 6

3. If you work 40 hours at the standard rate and 5 hours at the overtime rate – how much will you earn?

40 hours at the standard rate will be £520 (from question 2)

5 hours at £19.50 = 5 × £19.50 = £97.50

£520 + £97.50 = £617.50

Job B: Qualified bricklayer

Bricklayer - (Full-time / Temporary)

Job reference: 882431
Date notified: 29/06/2009
Job location: Ballymena
Salary: £8.50 per hour
Hours: 40
Worktime: 8.00am - 5.00pm
Age: 16 and over
Closing date: 03/07/2009
Pension type: Prefer Not to Say

4. What will the weekly salary be?

£8.50 × 40 = £340

NUMBER ANSWERS - TASK 6

5. Remembering that there are 52 weeks in a year, what is the annual salary?

£340 × 52 = £17 680

6. If you got Job A what would your annual salary be for a 40 hour week for 52 weeks? (Use your answer to question 2 where you worked out the weekly salary).

£520 × 52 = £27 040

7. How much more would you earn in Job A than Job B per year?

£27 040 - £17 680 = £9360

NUMBER ANSWERS - TASK 6

Job C: Site Foreman

HAYS

Hays Specialist Recruitment
9th Floor 14 Great Victoria Street Belfast BT 2 7BA
Tel: See Below www: www.Hays.com/NI
Fax: See Below Email See Below

Ref no:	NJ-44108
Title:	Civil Works Foreman (Belfast)
Date last updated by recruiter:	13 Aug 2009
Location:	Antrim,Belfast,Down
Job type:	Temporary Full-time
Salary:	£25000 - £35000
Additional benefits:	See Description
Role(s) That best describe this job	Foreperson - construction Site manager Site Agent
Qualifications:	See Description
Contact:	Oliver Smith

APPLY

8. What is the range in the salary for this job?

£35 000 - £25 000 = £10 000

NUMBER ANSWERS - TASK 6

9. The successful candidate for this post was given a salary of £27,300. How much does this work out at per month?

£27 300 ÷ 12 =£ 2 275

Monthly salary = £ 2 275

10. For the annual salary of £27,300 how much will the successful candidate earn per week? Remember there are 52 weeks in a year.

£27 300 ÷ 52 = £525

11. If the successful candidate is offered a 10% pay rise at the end of the first year, how much will their annual salary be?

To find 10 % of the salary, divide the total salary by 10.

10 % pay rise = £27 300 ÷ 10 = £2 730

£27 300 + £2 730 = £30 030

Annual salary = £30 030

NUMBER ANSWERS - TASK 7

CALCULATIONS

You are employed by a large construction company and are nearing completion of a private development of 8 houses. One of the new owners has requested a decked area be constructed to the rear of his premises adjacent to the garden. As this was not part of the original job specification you need to calculate the cost of this separately. It is important to be able to take account of materials requirements as well as labour and taxes where appropriate. Use the information given to answer the questions below to help you price this additional work.

Decking

EXAMPLE: To calculate how much decking you need for deck measuring 4mx3m use the table below:
Table showing the number of metres of 144mm deck boards required

METRES	1	2	3	4	5	6
1	7	14	21	28	35	42
2	14	28	42	56	70	84
3	21	42	63	84	105	126
4	28	56	**84**	112	140	168
5	35	70	105	140	175	210
6	42	84	126	168	210	252

From the table above you can see that a deck measuring 4mx3m you will need 84m of 144mm wide deck board.

If the deck boards you want come in 2.4m lengths, divide 84 by 2.4 = 35. You should buy 35 boards.

The cost of each length of board from the local supplier's website is shown below.

To calculate the total cost of the decking boards using a calculator, the sum is:

35 × £4.46 =

NUMBER ANSWERS - TASK 7

1. The answer on the screen is: 156.1. What does this mean the total cost of the decking is?

£156.10

2. Using the table below find the number of metres of deck board needed for a decked area measuring 5m by 6m.

Table showing the number of metres of 144mm deck boards required

METRES	1	2	3	4	5	6
1	7	14	21	28	35	42
2	14	28	42	56	70	84
3	21	42	63	84	105	126
4	28	56	84	112	140	168
5	35	70	105	140	175	210
6	42	84	126	168	210	252

Number of metres of deck board required is.....

210m

Compare

Reversible Treated Deck Board Smooth/Grooved Green Treated (L)2400 x (W) 144 x (T)28mm

EAN: 5022652800611

in store

Available for reserve & collect

Select a store to check stock & reserve & collect

home delivery

Not available

Only £4.46

Qty: 1

add to shopping list

NUMBER ANSWERS - TASK 7

3. The deck boards you want come in 2.4m lengths. How many lengths of deck board will you need?

210 ÷ 2.4 = 87.5

Be careful how you round your answer.

4. If each length of deck board costs £4.46, what is the total cost of the deck board?

88 × £4.46 = £392.48

Total cost

NUMBER ANSWERS - TASK 7

Paul is on his way home after a job. He is already thinking of work tomorrow and about getting tiles. He worked out earlier he needs just under 600 tiles for the next job. A slight detour on the way home would take him past the tile warehouse but as he has no trailer with him he could only fit one pallet in the van. If he needs more than one pallet he will leave it until tomorrow when he could call back with the trailer. It would save quite a bit of time if he could get the tiles today.

He knows from experience that the tiles he needs come in boxes with 4 tiles per box and that the boxes are stacked on the pallet in layers. Each layer has 5 by 6 boxes and there are 6 layers altogether. Paul is trying to work out in his head if this amounts to more than 600 tiles. He knows the calculation he needs to do is 4 x 5 x 6 x 6.

5. Can you think of a way to answer his question without having to do the calculation in full?

Is 4 x 5 x 6 x 6 more than 600?

Yes,
a. 20 x 36 is more than 20 x 30 which is 600
b. 24 x 30 is more than 20 x 30 which is 600

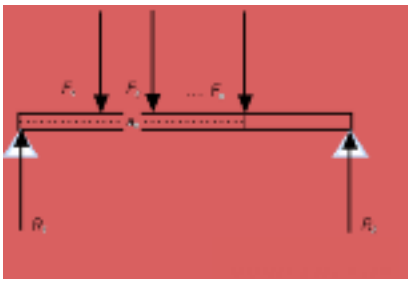
Will he call for the tiles on his way home? Please explain your reasoning

Yes

NUMBER ANSWERS - TASK 8

NEGATIVE NUMBERS

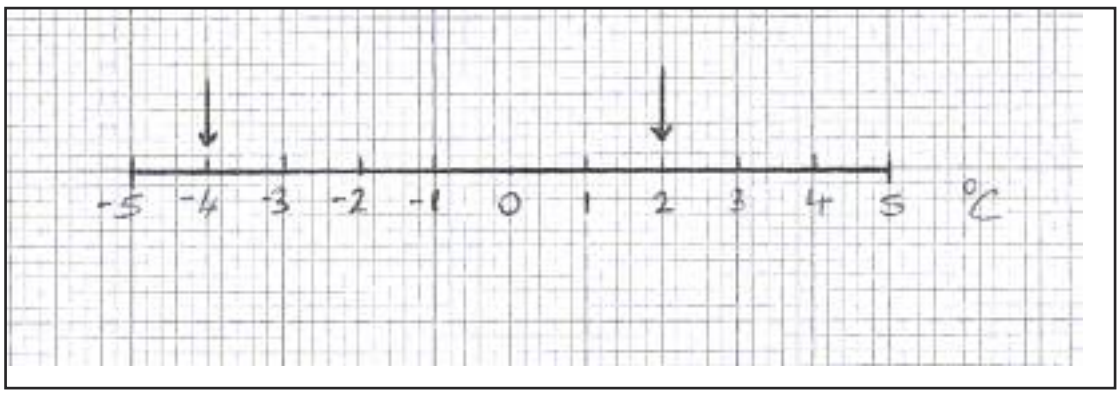
Negative numbers are numbers to the left (or below) zero on a number line. The use of negative numbers in construction is generally related to temperature, finances, height above/below sea level in surveying, direction of rotation e.g., clockwise or anticlockwise or the direction of forces that act in beams, columns, frames etc. You need to be able work with negative numbers accurately.



We will consider two construction related uses of negative numbers here; temperature and finances (bank statement).

In the Celsius temperature scale 0°C represents the freezing point of water. Be careful, it does not mean there is no heat energy present. It just means there isn't enough heat present for water to exist in liquid form so it freezes. A negative value on the Celsius scale indicates a temperature lower than 0°C where there is less heat energy present and so it feels colder.

1. In the space below construct a temperature scale (a number line) that extends from -5°C to 5°C in steps on 1°C. Use your ruler and work to a scale of 1cm for 1°C. Mark the temperatures -4°C and 2°C



NUMBER ANSWERS - TASK 8

2. In the space below identify the temperatures marked on the scale.

1°C, -3.5°C and -2°C respectively from left to right

3. If the answers above referred to external temperatures on a cold evening indicate which one is most likely to result in burst water pipes in a building if the heating was off.

-3.5°C

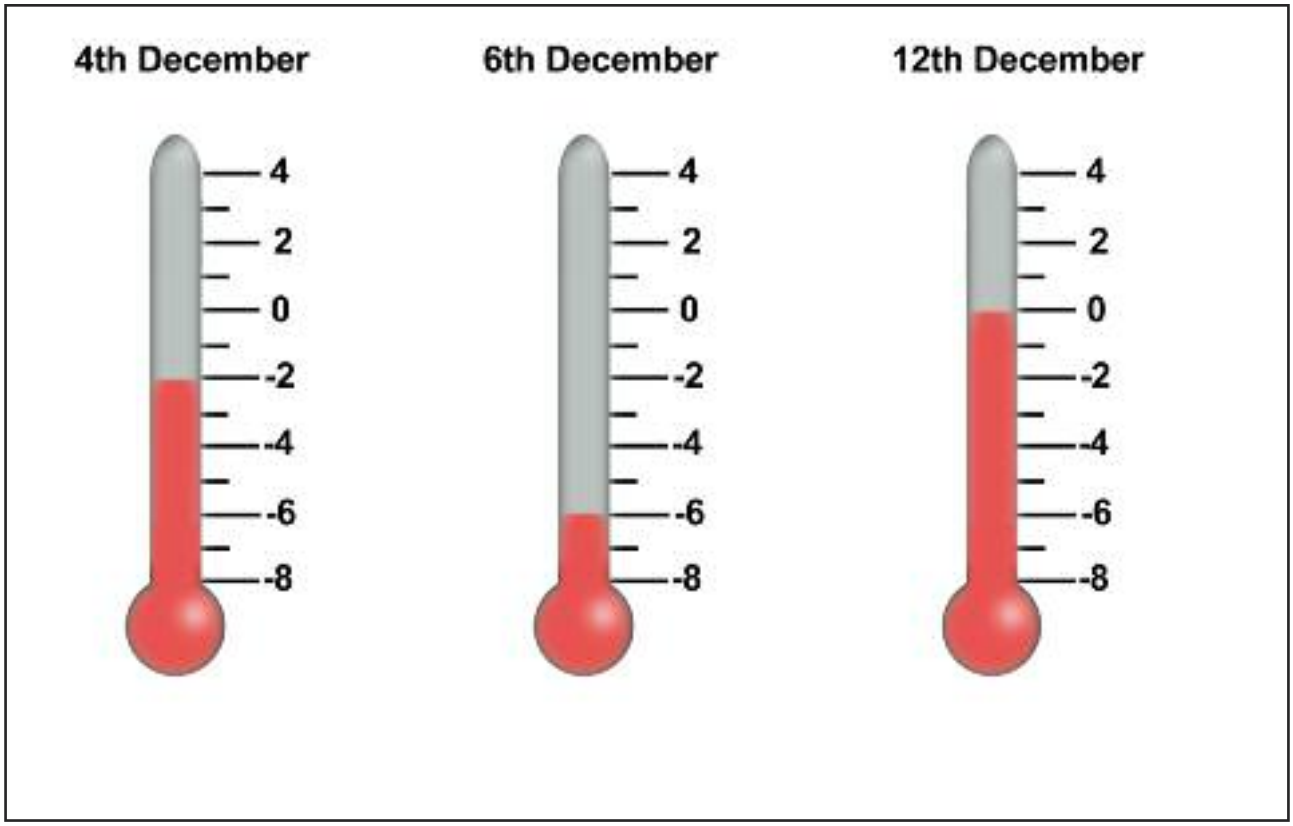
NUMBER ANSWERS - TASK 8

Ambient temperature is very important when laying asphalt. According to relevant British Standards the asphalt itself should be at 85° C but the ambient temperature should be no less than -3°C.

Janine has been checking temperatures over a period of two weeks and here are her results.

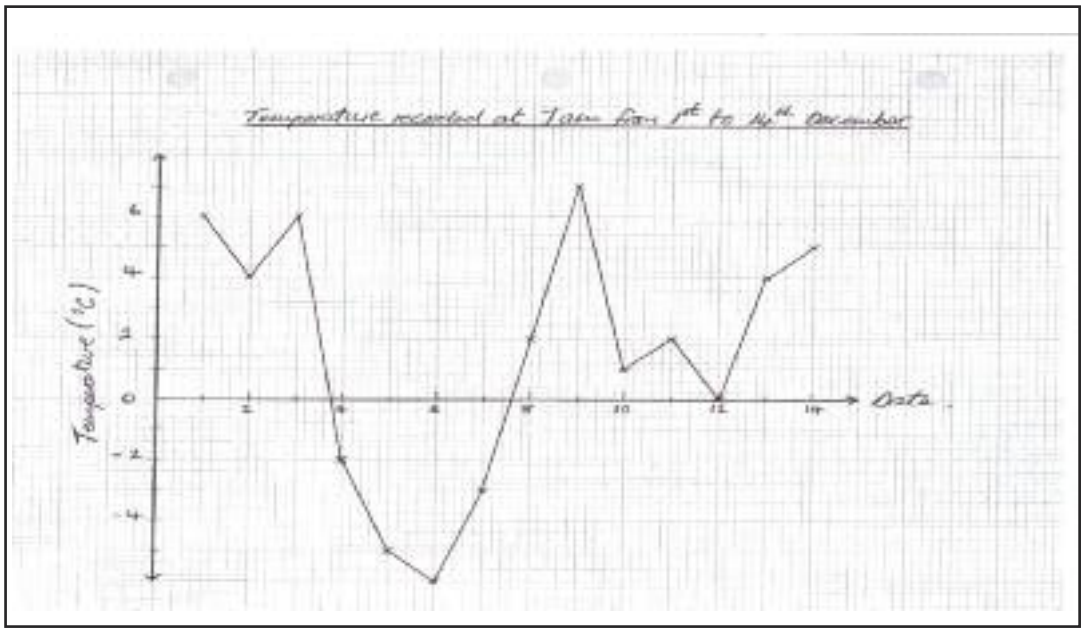
December	Temperature (°C)													
Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Temp	6	4	6	**-2**	-5	**-6**	-3	2	7	1	2	**0**	4	5

4. Values for 4th, 6th and 12th December are not shown in the table. The images below show the temperatures for these dates. Make each temperature reading and record the result in the table.



NUMBER ANSWERS - TASK 8

5. Using the graph below plot the remaining points. Join the points using a straight edge to produce a line graph showing how the temperature varied over the two-week period.



6. What was the highest temperature recorded and on which date did this occur?

Highest temperature:	7°C
Date:	9th December

7. What was the lowest temperature recorded and on which date did this occur?

Lowest temperature:	-6C°
Date:	6th December

NUMBER ANSWERS - TASK 8

8. What is the range of temperature during the second week in December?

Range = 7-0 = 7°C

9. On 4th December the temperature was -2°C. By the next day it had fallen to –5°C. Use the image below to work out by how many degrees the temperature changed?

3°C

NUMBER ANSWERS - TASK 8

Janine wants to work out the average temperature in the second week of December. To calculate the mean she has to add up all the temperatures for that week and divide the total by 7.

10. Janine's answer is 3.5°C. Her colleague Brendan says that the answer should be 3°C. Who is correct?

Show how you calculated your answer in the space below.

Write the sum of the temperatures here, Total = 2+7+1+2+0+4+5 = 21

Mean temperature = Total ÷ 7 = 21 ÷ 7 = 3°C

Who is correct?

Brendan is correct

11. On how many days during the two-week period could asphalt not have been laid?

2

NUMBER ANSWERS - TASK 9

FINANCE

Below is a bank statement for a construction engineering consultancy for the month of April 2009. The consultant wants to check the figures in the statement and this means he will need to look at withdrawals and lodgements on the account. He wants to know whether his account is in credit or debit and if the bank's calculations are correct.

Northern Regional Bank
Nicer Branch
Broad St
Lisburn
Co Antrim
Tel: 02890909090

Statement of Account
Sort: 09-59-01
A/C 555362744
Date 12.04.09

FE Dylan
18 Mull Rd
Ballinderry
Lisburn

Date	Details	Debits	Credits	Balance
01 Apr	Opening Balance			996.87
03 Apr	Standing order 001	288.44		708.43
04 Apr	Cheque 234016	174.45		533.98
08 Apr	Cash paid in		372.00	905.98
09 Apr	Cheque 234017	277.30		628.68
11 Apr	Cheques paid in		540.50	1169.18
15 Apr	Standing order 002	569.45		599.73
16 Apr	Cash paid in		340.18	939.91
21 Apr	Cheques for salary	840.37		99.54
23 Apr	Cash paid in		540.34	639.88
26 Apr	Cheque paid in		2277.45	2917.33
29 Apr	Cash paid in		2480.32	5397.65
30 Apr	Closing Balance			5397.65

NUMBER ANSWERS - TASK 9

1. Fill in the balance column as far as 29th April. The balance on 29th April should be £5397.65, allowing you to check your answer. Use the space below as well if you need to.

2. On which day was the account at its lowest point and how much did he have in the bank on that date?

Date: 21st April

Balance: £99.54

3. A cheque of £6000 for salaries is withdrawn from the account on 30th April taking the account to -£602.35. What does the negative sign mean?

The account is overdrawn by the amount £602.35

Measure, Shape & Space
Tasks and Answers

This section mainly addresses the curriculum area specified, however to allow a more realistic setting for each task, some elements from other curriculum areas may also be mentioned.





MEASURE, SHAPE & SPACE TASK 1

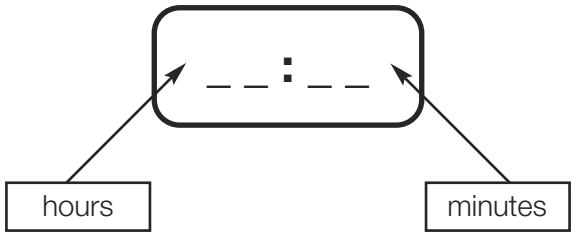
TIME

In construction time is money. It is important that you manage time effectively and estimate the time required to complete a job as accurately as possible. It is also important to record time accurately. On 25 September 2009 an accident occurred on a construction site. The contractor was McClure Construction. Jason Shepherd was on scaffolding when he fell. The accident occurred at 13:09. An ambulance was called for and arrived at 14:06.

With 12 hour clock each day is split into two halves, am (before midday) and pm (after midday).

24 hour clock is used in digital clocks, timers and timetables. The hours are numbered up to 24 instead of using am and pm, starting at 00:00 for midnight.

4 digits are used when writing times in 24 hour clock:



Example:

- Twenty five minutes to two in the morning
- 1:35am is the time as 12 hour clock
- 01:35 is the time as 24 hour clock

- Quarter past four in the afternoon
- 4:15pm
- 16:15

- Add 12 Hours to pm times.
- Subtract 12 Hours to find the pm time.

Finding the difference between times

Example:

If you start work at 08:15 and stop for lunch at 12:40, how long have you worked for?

- Find the number of minutes to the next hour i.e.
  8:15 to 9:00 => **45 minutes**
- Then find the number of hours and minutes to the final time:
  9:00 to 12:40 => **3 hours and 40 minutes**
- Total the hours and the minutes separately:
  3 hours + 40 minutes + 45 minutes = 3 hours and 85 minutes = **4 hours and 25 minutes**

85 minutes = 60 mins + 25 mins
= 1 hour and 25 minutes

MEASURE, SHAPE & SPACE TASK 1

1. What time did the accident occur in 12 hour clock?

2. What time did the ambulance arrive in 12 hour clock?

3. How long after the accident did the ambulance arrive?

4. If the call was placed for the ambulance at 13:51, how long did it take between the ambulance being called and it arriving?

5. Jason arrived on site that morning at 8:50am. How is this written in 24 hour clock?

MEASURE, SHAPE & SPACE TASK 1

6. The site foreman calculates that if Jason arrived on site at 8:50am and the accident occurred at 13:09, then he had been on site:

13:09 – 8:50 = 4:59 i.e. 4 hours 59 minutes.

Has he calculated this correctly? If he has made an error, what mistake did he make and what is the correct length of time?

7. The employees on site that day started and finished at the times shown below:

EMPLOYEE	START TIME	FINISH TIME
Claire	08:30	Twenty five minutes to five in the afternoon
Sean	Quarter past eight	4:15
Peter	09:05	16:41
Adrian	7:59	Quarter to five in the afternoon
Dean	08:35	16:30

Calculate how long each employee worked that day.

EMPLOYEE	TIME WORKED
Claire	
Sean	
Peter	
Adrian	
Dean	

MEASURE, SHAPE & SPACE TASK 1

8. Peter had started at 08:05 and agrees to start a quarter of an hour earlier the next day. What time will he start at?

9. Dean started work at 08:35. Is this 12 hour or 24 hour clock?

10. 7 days after the accident Jason is well enough to return to work. What date did he return to work?

Accident date: 25/09/09

Return to work date:

11. When Jason returns to work he started at 8:05am and worked 7 hours and 50 minutes. What time did he finish?

MEASURE, SHAPE & SPACE TASK 1

12. Jason gets a lift to work with Sean. The journey from Dungannon takes 85 minutes because of delays on the M1. How long did the journey take in hours and minutes?

13. If Jason and Sean arrive on site at 8:05am, what time did they leave Dungannon? (Remember the journey took 85 minutes).

14. In order to make it to back to Dungannon for an appointment at quarter to six that evening, what time will Jason need to get the bus from Belfast?.

(Note that timetables sometimes omit the colon)

Belfast, Europa Buscentre - Dungannon - Enniskillen — Goldline Express Service 261

Monday to Friday

Belfast, Europa Buscentre	0805	0905	1005	1105	1135	1205	1305	1405	1505	1605	1705	1805	1905	2005	2205
Dungannon, Bus Station	0900	1000	1100	1200	|	1300	1400	1500	1600	1700	1800	1900	2000	2100	2300
Dungannon, Bus Station	0903	1003	1103	1203	|	1303	1403	1503	1603	1703	1803	1903	2003	2103	
Enniskillen, Buscentre	1020	1120	1220	1320	1325	1420	1520	1620	1720	1820	1920	2020	2120	2220	

Saturday

Belfast, Europa Buscentre	0905	1005	1105	1205	1305	1405	1505	1605	1705	1805	2005
Dungannon, Bus Station	1000	1100	1200	1300	1400	1500	1600	|	1800	1900	2100
Dungannon, Bus Station	1003	1103	1203	1303	1403		1603	|		1903	2103
Enniskillen, Buscentre	1120	1220	1320	1420	1520		1720	1810		2020	2220

Sunday

Notes:	A	A				
Belfast, Europa Buscentre	*0945*	*1305*	1445	1605	1745	2005
Dungannon, Bus Station	*1040*	*1400*	1540	1700	1840	2100
Dungannon, Bus Station	1045	1403		1703		2103
Enniskillen, Buscentre	1200	1520		1820		2220

A — Passengers to/from Belfast are required to change at Dungannon from Service 273

Departure times are shown from main Ulsterbus Stations, intermediate timing points show estimated times which are dependent on traffic conditions.

MEASURE, SHAPE & SPACE TASK 1

15. How long did the bus take?

16. How much shorter was the journey home than the journey to work?

17. Claire usually works 8 hours 15 minutes each day. How long does she work over the course of the 5 day working week?

MEASURE, SHAPE & SPACE TASK 2

MEASURING

In the construction industry it is important to be able to take accurate measurements. Where inaccuracies occur this may lead to loss in profit, time or even compromise safety on site.

In Northern Ireland we use miles to measure distance on the road. In the rest of Europe, long distances are measured in kilometres.

1 mile is longer than 1 kilometre
1 km = 1000m

km stands for kilometre
m stands for metre

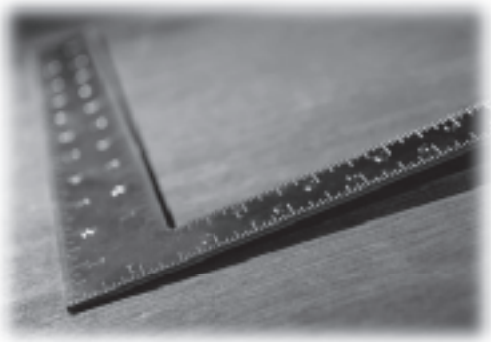
On a tape measure centimetres and millimetres are marked.

1m = 100cm =1000mm
m stands for metre
cm stands for centimetre
mm stands for millimetre

Some rulers are marked in centimetres and millimetres.
1cm = 10mm
Notice from the ruler that the line is 22mm. This is the same as 2.2cm.

MEASURE, SHAPE & SPACE TASK 2

What do each of the items below measure and what unit will they measure in?

Instrument	Used to measure?	Unit
		
		
		
		
		

MEASURE, SHAPE & SPACE TASK 2

Instrument	Used to measure?	Unit
		
		
		

In construction we mainly use **metric units** for measuring. Where have you come across the metric units below at work?

Fill in examples of where you have come across that unit in work.

MEASURE, SHAPE & SPACE TASK 2

METRIC UNITS

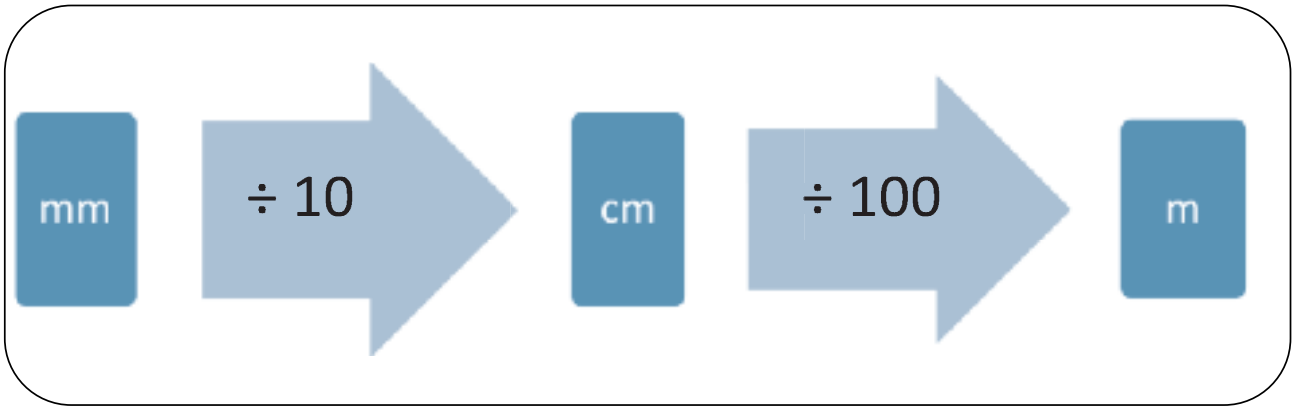
	ABBREVIATION	FULL NAME	EQUIVALENT	EXAMPLES
MEASUREMENT OF LENGTH	mm	millimatre	10 mm = 1 cm 1 000 mm = 1 m	
	cm	centimetre	100 cm = 1 m	
	m	metre	1 000 m = 1 km	
	km	kilometre	1 000 m = 1 km	
MEASUREMENT OF WEIGHT	g	gram	1000g = 1 km	
	kg	kilogram	1kg = 1000g	
	t	tonne	1t = 1000kg	
MEASUREMENT OF CAPACITY	ml	millilitre	1l = 1000ml	
	l	litre	1l = 1000ml	

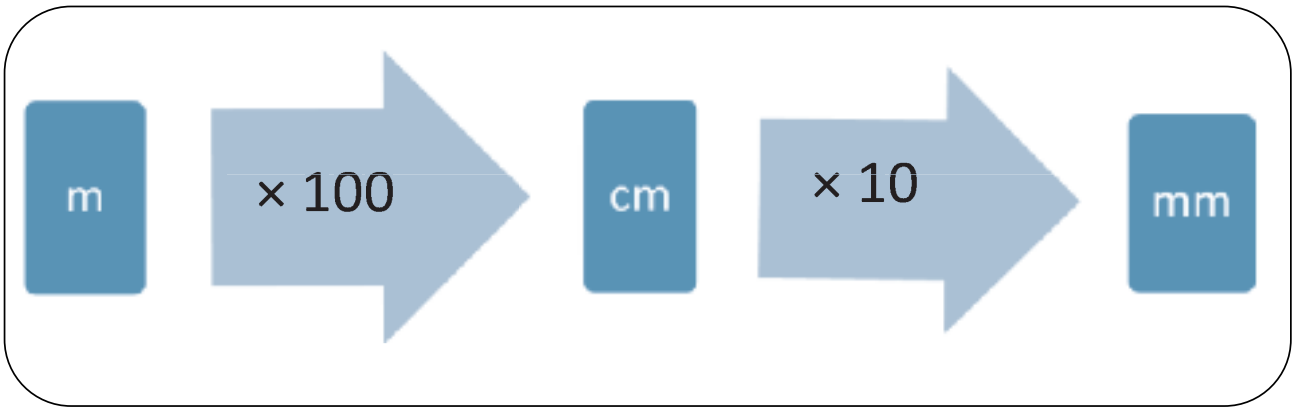
MEASURE, SHAPE & SPACE TASK 3

CONVERTING BETWEEN METRIC UNITS OF MEASURE

On site most measurements are in metres but when moving down into detail you will need to be able to convert into millimetres.

Worktops are to be fitted in a joinery workshop. The worktop comes in 5m lengths but the site plans showing the layout of the benches have the measurements in mm. When you take the actual measurements on site these will need to be converted.





EXAMPLES

700mm = 70cm	*700 ÷ 10 = 70*
1200mm = 1.2m	*1200 ÷ 1000 = 1.2*
1.3m = 1300mm	*1.3 × 1000 = 1300*

MEASURE, SHAPE & SPACE TASK 3

Rulers and tape measures are marked off in cm

1. The arrow is pointing at what measurement? (give your answer in cm and in mm)

2. The arrow is pointing at what measurement? (give your answer in cm and in mm)

3. The arrow is pointing at what measurement? (give your answer in cm and in mm)

MEASURE, SHAPE & SPACE TASK 3

4. The arrow is pointing at what measurement? (give your answer in cm and in mm)

5. The arrow is pointing at what measurement? (give your answer in cm and in mm)

6. You have to cut skirting to measure 1010mm. If your tape measure is in cm, what length is 1010 mm in cm?

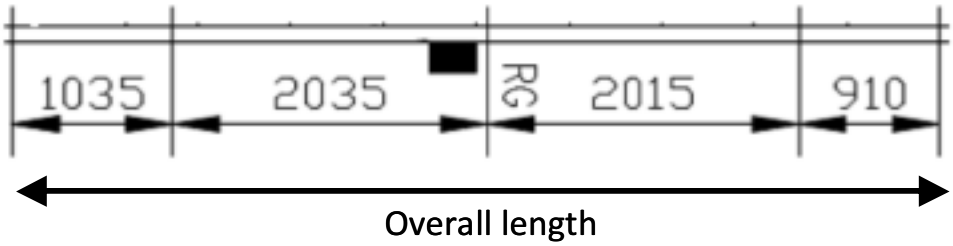
7. A length of pipe needs to be 1570mm long. What is this length in metres?

MEASURE, SHAPE & SPACE TASK 4

SITE PLANS

Karen works for a construction firm and needs to be able to translate the measurements from the plans she has been given to actual lengths on site. This requires her to accurately measure lengths on the drawings and interpret what these lengths mean on the site. Look at the plans below and check your understanding of site plans.

Measurements are in mm



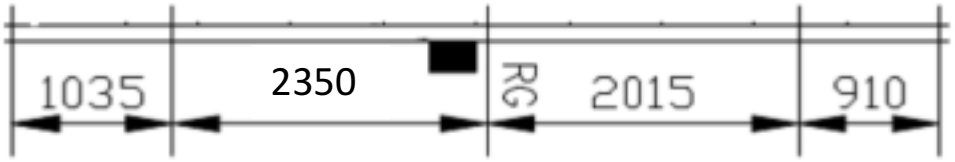
1. What is the overall length of this section of the site?

2. What is 2035mm in metres?

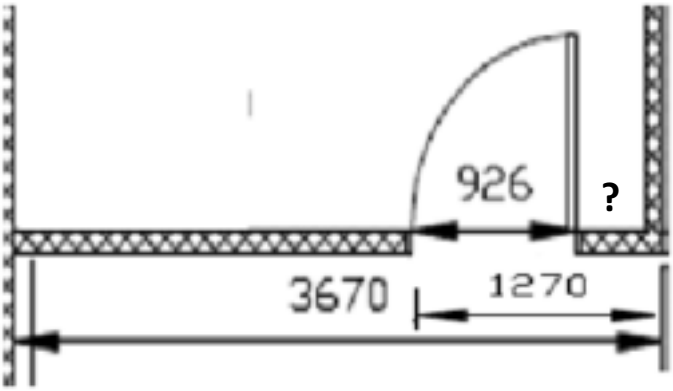
3. The architect thinks he has made a mistake and the 2035mm measurement should be 2.35m. Are these two measurements different? If so, what is the difference?

MEASURE, SHAPE & SPACE TASK 4

The plan is changed to incorporate the changed measurement.

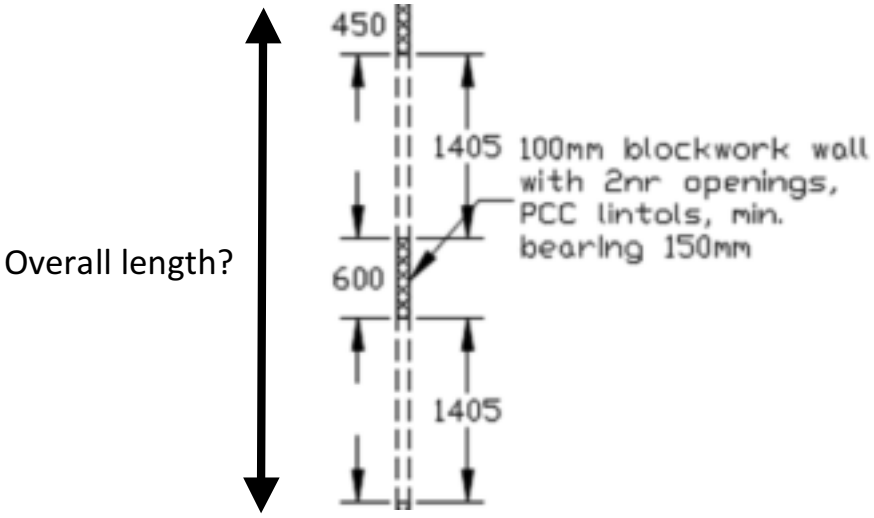


4. Calculate the overall length now.



5. There is a measurement missing from the plan above. What is the missing measurement?

MEASURE, SHAPE & SPACE TASK 4



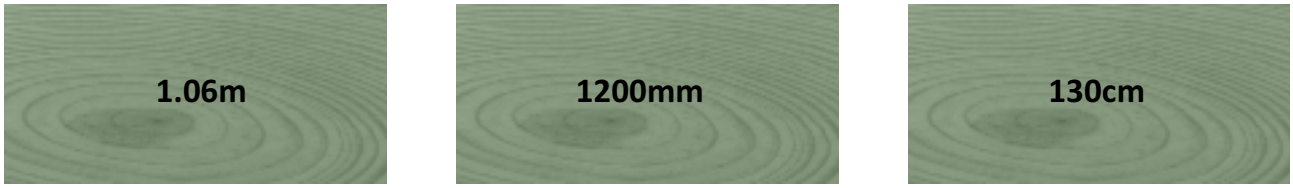
6. What is the total overall length shown by the arrow?

MEASURE, SHAPE & SPACE TASK 5

MATERIALS

When working with different materials on site you need to be able to compare quantities such as lengths and weights. From the weight of a steel H-section which will need to be accurately counterbalanced when using a crane on site, to quantities of stone and other building materials, you need to be able to work with metric measurements. Lengths of timber, pipe and steel etc need to be accurately known. Measurements may be given in a variety of units and you need to be able to convert from one unit to another. Test your understanding in the questions below.

1. Put these lengths in ascending order.



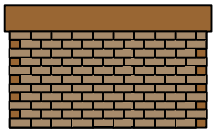
2. Put these lengths in ascending order.

3. Put these weights in order of size.

23.06kg 23.6kg 23500g

MEASURE, SHAPE & SPACE TASK 5

4. Match each of these items to their approximate measurement.

 **Height of door**	**0.8m**
 **Width of door**	**1900mm**
 **Length of a brick**	**2250mm**
 **Height of garden wall**	**230mm**
 **Height of garage door**	**1.2m**

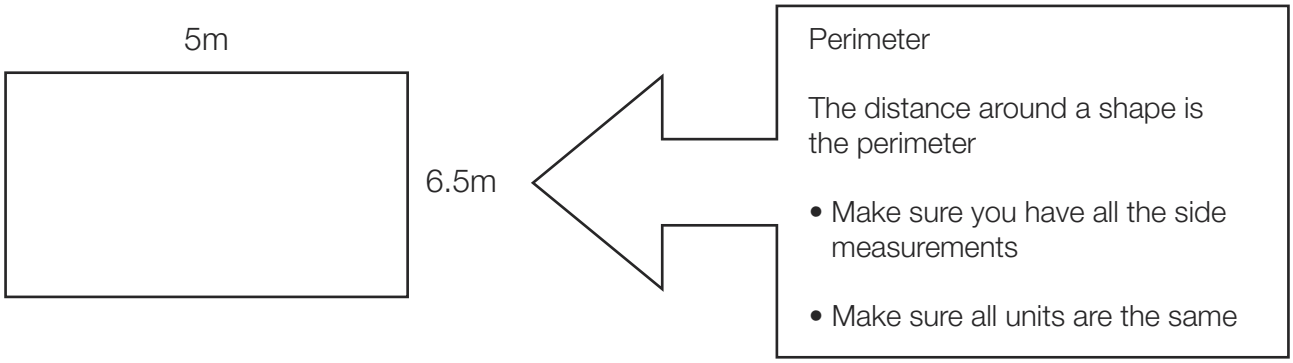
MEASURE, SHAPE & SPACE TASK 6

PERIMETER

A load of timber skirting has arrived and you are on site and have been asked to lay out the required amount of timber skirting in each room.

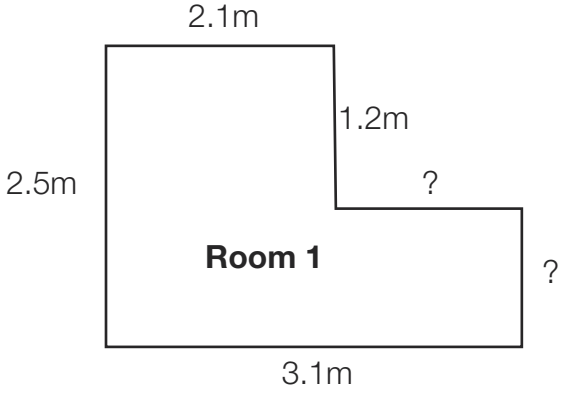
To do this you need to be able to calculate the perimeter of the room. But you will also need to remember that skirting comes in 4.2 metre lengths.

Room 1



1. What is the perimeter of the room?

2. If the standard length of skirting is 4.2m, how many lengths of skirting will you need to lay out in the room?



MEASURE, SHAPE & SPACE TASK 6

3. What are the lengths of the two sides shown by question marks?

4. What is the perimeter of the room?

5. Remembering that skirting comes in 4.2 m lengths, work out how many lengths you will need to lay out in the room?

6. If you had worked out the amount of skirting needed by dividing the perimeter by 4.2 you would have got 2.6 lengths of skirting (about 3 lengths of skirting). How is this answer different from the answer you got to question 5? Which is answer is correct and why?

MEASURE, SHAPE & SPACE TASK 7

AREA

The client would like to get an estimate for a new concrete floor to be put down in an outhouse. In order to calculate the estimate you need to work out the area of the floor. This means taking measurements of the length and width of the floor and converting measurements to metres in order to find the area in squared metres.

length

Area = length x width	**width**

Plan of outhouse:

3 m

Outhouse	**2.63 m**

What is the area of the room?

The area of the room to be floored is:

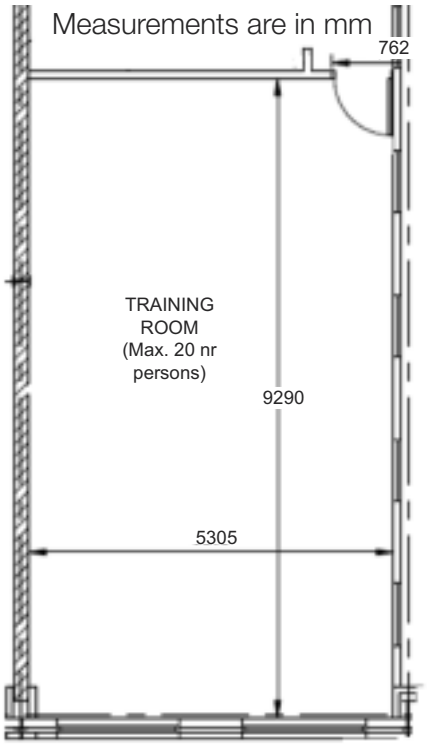
MEASURE, SHAPE & SPACE TASK 8

PLANS

Measurements can be taken directly from site plans and used in calculations off site.
A site plan is a bird's eye view of a property that is drawn to scale. A site plan can show:

- Property lines
- Outline of existing and proposed buildings and structures
- Distance between buildings
- Distance between buildings and property lines (setbacks)
- Parking lots, indicating parking spaces
- Driveways
- Surrounding streets
- Landscaped areas
- Easements
- Ground sign location

When working from plans you will need to be able to interpret the plans and the measurements on the plans to accurately calculate quantities.



1. From the upstairs plan what is the perimeter of the room in mm?

MEASURE, SHAPE & SPACE TASK 8

2. What would this be in metres?

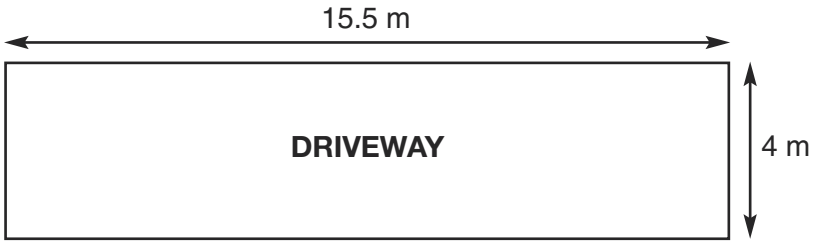
3. What is the width of the door for the training room?

4. What length of skirting would be needed for the room? (remember to leave out the door)

MEASURE, SHAPE & SPACE TASK 9

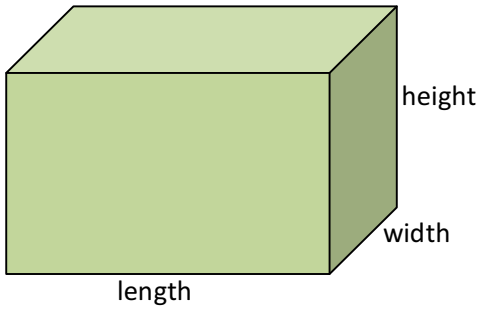
LAYING A CONCRETE DRIVEWAY

RS Contracts have received an order to lay a concrete driveway for a customer. The dimensions of the driveway have been measured as below:



In order to accurately calculate the quantity of concrete required, RS Contacts need to calculate the volume of concrete required. Follow the steps to complete the calculation.

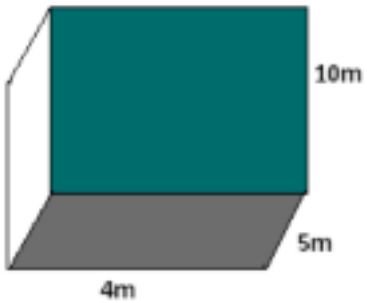
Volume = length × width × height



To order material such as stones for a path or concrete for a driveway or foundations, you need to calculate the volume. Volumes are normally measured in units cubed such as metres cubed.

MEASURE, SHAPE & SPACE TASK 9

EXAMPLE



For this example the volume is $4 \times 5 \times 10 = 200m^3$

To determine the volume of concrete needed, RS contracts multiply the length and width of the driveway by the depth of concrete to be laid, in this case 100mm.

1. What volume of concrete will they need to order?

Length of driveway in metres =

Width of driveway in metres =

Depth of concrete in METRES =

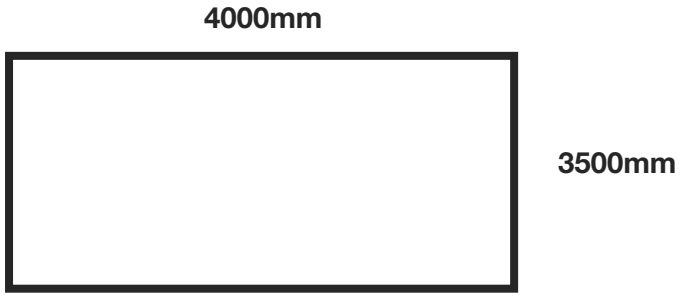
Volume of concrete =

2. As a general rule: one cubic metre of concrete weighs around 2.5 tonnes. Using this method, how many tonnes of concrete will you need to order?

MEASURE, SHAPE & SPACE TASK 10

ERECTING A SHED

You need to build a raft for an NIE substation. The excavation has already been completed and the hard core levelled. You now need to erect the shuttering for the base.



1. What are the dimensions of the concrete base in metres?

4000mm =

3500mm =

2. If the concrete for the base needs to be 225mm thick what volume of concrete will be needed in metres cubed?

REMEMBER: ***Volume = length × width × height***

Length in m =

Width in m =

Height in m =

Volume =

3. Concrete costs approximately £60 per metre cubed including VAT. What will the cost be for the concrete?

MEASURE, SHAPE & SPACE TASK 10

4. There are three sizes of lorry that can deliver concrete.

Lorry A can carry $3m^3$ of concrete

Lorry B can carry $5m^3$ of concrete

Lorry C can carry $7m^3$ of concrete

Which is the most cost effective lorry to use?

5. If two substation bases need to be built what is the total volume of concrete needed?

6. Remembering that there are three sizes of lorry that can deliver concrete.

Lorry A can carry $3m^3$ of concrete

Lorry B can carry $5m^3$ of concrete

Lorry C can carry $7m^3$ of concrete

Which is the most cost effective lorry to use to deliver the concrete for the two substation bases? What volume of concrete will be left over from the lorry load?

MEASURE, SHAPE & SPACE TASK 10

7. What volume of concrete will be left over from the lorry load? How could this wastage be used? – suggest where.

MEASURE, SHAPE & SPACE TASK 11

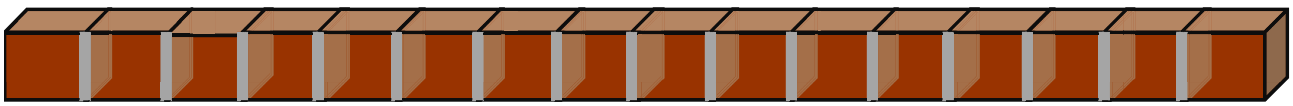
BRICK WALL

James has been working on a residential development for McClarty construction and is to build a small wall in front of one of the properties. This will be the first time he has undertaken a project from start to finish. He needs to do a range of calculations for instance the amount of brick, mortar, concrete etc. required to complete the job. The task below will take him through the various stages of each calculation.

Each brick measures:

21.5 cm x 10.25 cm x 6.5 cm

1. What are the dimensions of the brick in mm?



The first bricks have been laid as shown above.

2. If the thickness of mortar is 10mm. What is length of the wall so far?

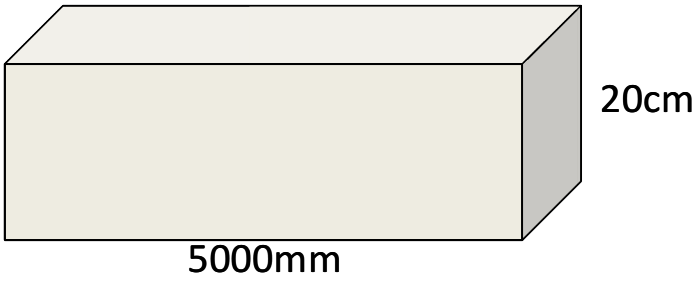
3. Mortar is made up from 1 part cement to 4 parts sand.
How much sand would be needed to mix with 2 buckets of cement?

1 part cement	**to**	**4 parts sand**
2 buckets of cement	**to**	**_____ buckets of sand**

MEASURE, SHAPE & SPACE TASK 11

4. When the wall around the garden is completed it will contain 120 bricks. Each brick costs 40p. How much will all the bricks required for the wall cost?

For a small garden wall, a foundation is dug as shown below.



The width of the foundation is twice the width of a brick plus 10mm.

5. If a brick is 102.5mm wide, what will the width of the foundation be?

MEASURE, SHAPE & SPACE TASK 11

6. What are the dimensions of the foundation in metres?

Length =

Width =

Height =

7. What volume of concrete will you need for the foundation?

Volume of cuboid =

length × width × height

Volume of concrete = m^3

8. The concrete for the foundation is made up 1 part cement: 3 parts sand : 5 parts 10mm aggregate. If you have 8 buckets of cement, how many buckets of sand and aggregate will you need?

1 part cement	:	3 parts sand	:	5 parts 10mm aggregate
8 buckets of cement	:	_____	:	_____

MEASURE, SHAPE & SPACE TASK 12

MAPS

Chris lives in Newry and is a construction engineer for a large local firm. He has to make a visit to three of the company's sites tomorrow. The first site is in Ballycastle and Chris is trying to work out how far away it is. He takes out a map similar to the one you see below and begins to estimate the distance from Newry to Ballycastle.

1. Use a ruler to estimate the distance "as the crow flies" from Newry to Ballycastle if the map has a scale of 1cm to 4.5 miles.

Round the ruler measurement to the nearest cm

Convert this to miles using the scale given above

MEASURE, SHAPE & SPACE TASK 12

Chris realises this method is not very accurate so he attempts to use a slightly different approach. He breaks the journey into three “as the crow flies” legs.

- Newry to Belfast
- Belfast to Ballymena
- Ballymena to Ballycastle

2. Use the map again to calculate an improved estimate of the distance from Newry to Ballycastle and show your working in the space below

Newry to Belfast:
Ruler measurement in cm

Circle one option 4.0cm 4.5cm 5.0cm

Belfast to Ballymena:
Ruler measurement to nearest cm

Circle one option 3.0cm 3.5cm 4.0cm

Ballymena to Ballycastle:
Ruler measurement to nearest cm =

Circle one option 3.0cm 3.5cm 4.0cm

Add up the three measurements:

Total journey in cm =

Total journey in miles =

MEASURE, SHAPE & SPACE TASK 12

3. Round your answer above to the nearest 5 miles.

An internet search on www.multimap.com for this journey gives an answer of 92 miles.

4. Round this figure to the nearest 5 miles

The difference in the previous two answers could be described as the error in Chris's method.

5. What is the error in miles?

MEASURE, SHAPE & SPACE TASK 12

6. Which of the following answers do you feel best describes the percentage error in Chris's method? Don't do any further actual calculations to answer this.

Error in miles =
(answer to question 5)

Correct answer in miles =
(answer to question 4)

Circle one option

10% 33% 50% 100%

Reason:

After Chris visits the Ballycastle site he has to go to Magherafelt where his company are upgrading the spectator seating at a local rugby ground. From Magherafelt he will travel to a site in Armagh where his company are building a new shopping centre. After that he will go back to Newry.

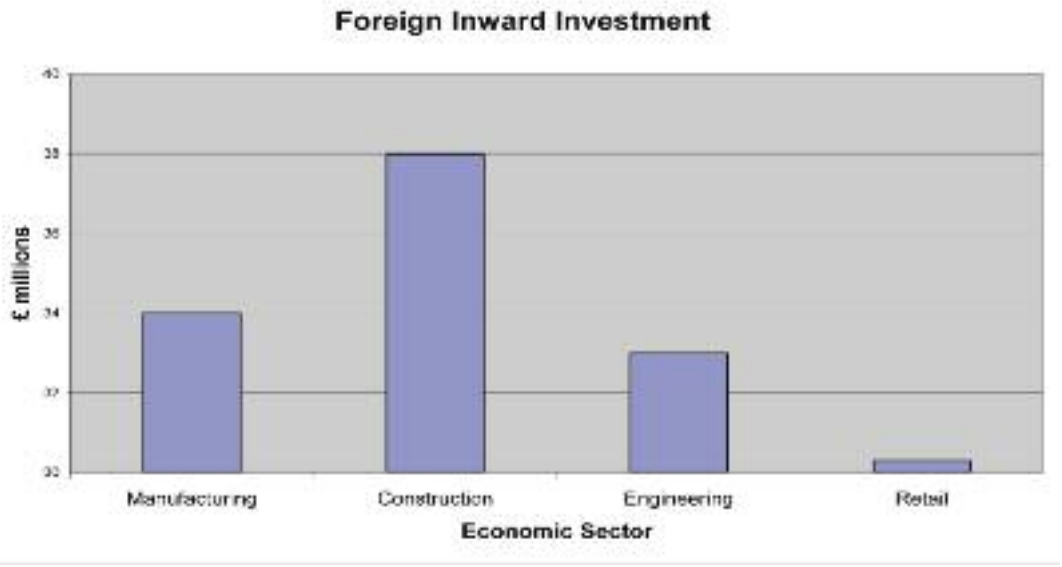
7. Use the mileage chart below to calculate how far Chris will have travelled altogether by the time he returns home again in the evening.

	Armagh	Ballycastle	Magherafelt	Newry
Armagh		95	33	19
Ballycastle	95		52	92
Magherafelt	33	52		51
Newry	19	92	51	

Mileage covered in total:

MEASURE, SHAPE & SPACE TASK 12

He arrives in Ballycastle just as the workers are having a tea break. Bill and Malachy are having a conversation about an article in the newspaper. The article includes the chart shown below.



Bill says Construction has received twice as much investment as manufacturing. Malachy agrees and thinks the retail sector has received very little indeed.

8. Comment on these statements in the space below.

Construction received twice as much as Manufacturing: Retail sector received very little:

MEASURE, SHAPE & SPACE TASK 12

There is an article is this paper about the rugby ground Chris's company are in the process of upgrading. The article states that the finished stadium is to have a seating capacity of 380,000 people and that 15,000 tonnes of concrete will have been used in the construction of it. According to the article the project was initially tendered at a cost of £18,000,000 but is due to come in over budget by 50% making the final total £18,900,000.

9. State whether or not you think these statistics are reasonable and if not indicate what may be wrong.

Capacity of 380,000 people

15000 tonnes of concrete

£18,000,000 increased by 50% gives £18,900,000

MEASURE, SHAPE & SPACE TASK 13

RENOVATION

John is going to put down a concrete floor and replace the beams in an old barn his company is developing. He takes some measurements with a tape and finds the barn floor is rectangular with dimensions 4.45m by 3.92m

1. Round these values up the nearest metre in order to make the volume calculation easier and allow for some wastage.

4.45m rounded up is

3.92m rounded up is

John knows the floor must be at least 3” deep so he decides to use 4” in his calculations to ensure he orders enough concrete and because he knows that 4” comes out at a round number when converted to cm. What is the number he is thinking of?

2. First of all use the fact that 1” = 25mm to convert to mm.

1” = 25mm so 4” = mm

3. Now convert this answer to cm.

10mm = 1cm

MEASURE, SHAPE & SPACE TASK 13

After doing the volume calculation he rings up to order 200m^3 of concrete. The person on the phone asks him if he is sure as that is a very large amount of concrete.

4. Is John correct? If not show how he went wrong in his calculation?

Remember	Volume = length x width x height

John also wants to use steel for the main beams. The table below gives some information on the price of steel beams according to their strength.

Beam Type	Max. load per metre in tonnes	Price (£)
A	1.2	80
B	1.8	
C	2.4	160
D	3.0	
E	4.8	

5. Use the figures given to help fill in the unknown prices. If you need to do some calculations use the space below the table:

MEASURE, SHAPE & SPACE TASK 13

Cameron is making a batch of mortar for John to finish some work behind the barn. Mixing sand and cement in different ratios helps produce different kinds of mortar.

A very hard mix as might be used for a floor would use 3:1 of sand to cement. A softer mortar mix such as is used for brickwork might use 6:1.

Cameron is making up a mix using the ratio 4:1 sand to cement. He has a 5 kg bag of cement.

6. How much sand does he need?

7. How much mortar mix will this make altogether?

Later Cameron is asked to make 50kg of mortar mix to the same hardness as the last batch. He wonders if there is a short cut to working out how much sand and cement to use for this batch.

8. Help give Cameron an answer in the space below.

MEASURE, SHAPE & SPACE ANSWERS - TASK 1

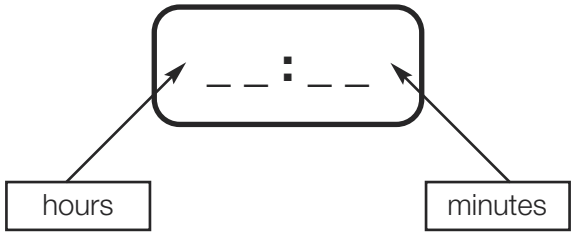
TIME

In construction time is money. It is important that you manage time effectively and estimate the time required to complete a job as accurately as possible. It is also important to record time accurately. On 25 September 2009 an accident occurred on a construction site. The contractor was McClure Construction. Jason Shepherd was on scaffolding when he fell. The accident occurred at 13:09. An ambulance was called for and arrived at 14:06.

With 12 hour clock each day is split into two halves, am (before midday) and pm (after midday).

24 hour clock is used in digital clocks, timers and timetables. The hours are numbered up to 24 instead of using am and pm, starting at 00:00 for midnight.

4 digits are used when writing times in 24 hour clock:



Example:

- Twenty five minutes to two in the morning
- 1:35am is the time as 12 hour clock
- 01:35 is the time as 24 hour clock

- Quarter past four in the afternoon
- 4:15pm
- 16:15

- Add 12 Hours to pm times.
- Subtract 12 Hours to find the pm time.

Finding the difference between times

Example:

If you start work at 08:15 and stop for lunch at 12:40, how long have you worked for?

- Find the number of minutes to the next hour i.e.
  8:15 to 9:00 => **45 minutes**
- Then find the number of hours and minutes to the final time:
  9:00 to 12:40 => **3 hours and 40 minutes**
- Total the hours and the minutes separately:
  3 hours + 40 minutes + 45 minutes = 3 hours and 85 minutes = **4 hours and 25 minutes**

85 minutes = 60 mins + 25 mins
= 1 hour and 25 minutes

MEASURE, SHAPE & SPACE ANSWERS - TASK 1

On 25 September 2009 an accident occurred on a construction site. The contractor was McClure Construction. Jason shepherd was on scaffolding when he fell. The accident occurred at 13:09. An ambulance was called for and arrived at 14:06.

1. What time did the accident occur in 12 hour clock?

1:09pm

2. What time did the ambulance arrive in 12 hour clock?

2:06pm

3. How long after the accident did the ambulance arrive?

From 1:09pm to 2pm would be 51 minutes

From 2pm to 2:06pm would be 6 minutes

This gives a total of 51 + 6 = 57 minutes

4. If the call was placed for the ambulance at 13:51, how long did it take between the ambulance being called and it arriving?

From 13:51 to 14:00 is 9 minutes

From 14:00 to 14:06 is 6 minutes

This is a total of 9 + 6 = 15 minutes

5. Jason arrived on site that morning at 8:50am. How is this written in 24 hour clock?

08:50

MEASURE, SHAPE & SPACE ANSWERS - TASK 1

6. The site foreman calculates that if Jason arrived on site at 8:50am and the accident occurred at 13:09, then he had been on site:

13:09 – 8:50 = 4:59 i.e. 4 hours 59 minutes.

Has he calculated this correctly? If he has made an error, what mistake did he make and what is the correct length of time?

Jason subtracted the clock times as though they were decimals.

The correct method is:

From 8:50 to 9:00 is 10 minutes

From 9:00 to 13:09 is 4 hours 9 minutes

The total time is 4 hours and 19 minutes

7. The employees on site that day started and finished at the times shown below:

EMPLOYEE	START TIME	FINISH TIME
Claire	08:30	Twenty five minutes to five in the afternoon
Sean	Quarter past eight	4:15
Peter	09:05	16:41
Adrian	7:59	Quarter to five in the afternoon
Dean	08:35	16:30

MEASURE, SHAPE & SPACE ANSWERS - TASK 1

Calculate how long each employee worked that day.

EMPLOYEE	TIME WORKED
Claire	8:30 to 9:00 is 30 minutes 9:00 to 4:35pm is 7 hours and 35 minutes The total is 30 minutes + 7 hours and 35 minutes = 7 hours and 65 minutes = 8 hours and 5 minutes
Sean	8:15 to 9:00 is 45 minutes 9:00 to 4:15pm is 7 hours 15 minutes The total is 45 minutes + 7 hours and 15 minutes = 7 hours and 60 minutes = 8 hours
Peter	9:05 to 10:00 is 55 minutes 10:00 to 16:41 is 6 hours and 41 minutes The total is 55 minutes + 6 hours and 41 minutes = 6 hours and 96 minutes = 7 hours and 36 minutes
Adrian	7:59 to 8:00 is 1 minute 8:00 to 4:45pm is 8 hours and 45 minutes The total is 1 minute + 8 hours and 45 minutes = 8 hours and 46 minutes
Dean	8:35 to 9:00 is 25 minutes 9:00 to 16:30 is 7 hours and 30 minutes The total is 25 minutes + 7 hours and 30 minutes = 7 hours and 55 minutes

8. Peter had started at 08:05 and agrees to start a quarter of an hour earlier the next day. What time will he start at?

07:50 or 7:50am or ten minutes to eight in the morning

9. Dean started work at 08:35. Is this 12 hour or 24 hour clock?

24 hour clock

MEASURE, SHAPE & SPACE ANSWERS - TASK 1

10. 7 days after the accident Jason is well enough to return to work. What date did he return to work?

Accident date: 25/09/09

Return to work date: 2/10/09 or 2nd October 2010

11. When Jason returns to work he started at 8:05am and worked 7 hours and 50 minutes. What time did he finish?

8:05 + 7 hours is 15:05

15:05 + 50 minutes is 15:55

Jason finishes at 15:55 or 3:55pm or 5 minutes to four in the afternoon

12. Jason gets a lift to work with Sean. The journey from Dungannon takes 85 minutes because of delays on the M1. How long did the journey take in hours and minutes?

1 hour and 25 minutes

13. If Jason and Sean arrive on site at 8:05am, what time did they leave Dungannon? (Remember the journey took 85 minutes).

8:05 less 1 hour is 7:05

7:05 less 25 minutes is 6:40

They left at 6:40am or 06:40 or twenty minutes to seven in the morning.

MEASURE, SHAPE & SPACE ANSWERS - TASK 1

14. In order to make it to back to Dungannon for an appointment at quarter to six that evening, what time will Jason need to get the bus from Belfast?.

(Note that timetables sometimes omit the colon)

Belfast, Europa Buscentre - Dungannon - Enniskillen Goldline Express Service 261

Monday to Friday														
Belfast, Europa Buscentre	0805	0905	1005	1105	1135	1205	1305	1405	1505	1605	1705	1805	1905	2005	2205
Dungannon, Bus Station	0900	1000	1100	1200	|	1300	1400	1500	1600	1700	1800	1900	2000	2100	2300
Dungannon, Bus Station	0903	1003	1103	1203	|	1303	1403	1503	1603	1703	1803	1903	2003	2103	
Enniskillen, Buscentre	1020	1120	1220	1320	1325	1420	1520	1620	1720	1820	1920	2020	2120	2220	

Saturday											
Belfast, Europa Buscentre	0905	1005	1105	1205	1305	1405	1505	1605	1705	1805	2005
Dungannon, Bus Station	1000	1100	1200	1300	1400	1500	1600	|	1800	1900	2100
Dungannon, Bus Station	1003	1103	1203	1303	1403		1603	|		1903	2103
Enniskillen, Buscentre	1120	1220	1320	1420	1520		1720	1810		2020	2220

Sunday						
Notes:	A	A				
Belfast, Europa Buscentre	*0945*	*1305*	1445	1605	1745	2005
Dungannon, Bus Station	*1040*	*1400*	1540	1700	1840	2100
Dungannon, Bus Station	1045	1403		1703		2103
Enniskillen, Buscentre	1200	1520		1820		2220

A — Passengers to/from Belfast are required to change at Dungannon from Service 273

Departure times are shown from main Ulsterbus Stations, intermediate timing points show estimated times which are dependent on traffic conditions.

16:05

15. How long did the bus take?

1 hour less 2 minutes that means 58 minutes

MEASURE, SHAPE & SPACE ANSWERS - TASK 1

16. How much shorter was the journey home than the journey to work?

The journey took 85 minutes by car and 58 minutes by bus. 85 – 58 = 27 minutes shorter

17. Claire usually works 8 hours 15 minutes each day. How long does she work over the course of the 5 day working week?

8 hours × 5 = 40 hours

15 minutes × 5 = 75 minutes = 1 hour and 15 minutes

Total = 41 hours and 15 minutes

MEASURE, SHAPE & SPACE ANSWERS - TASK 2

MEASURING

In the construction industry it is important to be able to take accurate measurements. Where inaccuracies occur this may lead to loss in profit, time or even compromise safety on site.

In Northern Ireland we use miles to measure distance on the road. In the rest of Europe, long distances are measured in kilometres.

1 mile is longer than 1 kilometre
1 km = 1000m

km stands for kilometre
m stands for metre

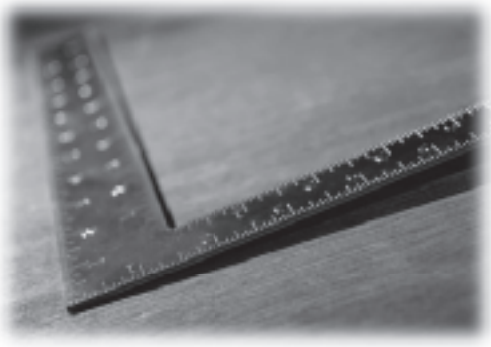
On a tape measure centimetres and millimetres are marked.

1m = 100cm =1000mm
m stands for metre
cm stands for centimetre
mm stands for millimetre

Some rulers are marked in centimetres and millimetres.
1cm = 10mm
Notice from the ruler that the line is 22mm. This is the same as 2.2cm.

MEASURE, SHAPE & SPACE ANSWERS - TASK 2

What do each of the items below measure and what unit will they measure in?

Instrument	Used to measure?	Unit
	Distance	mm / cm / inches
	Distance	mm / m
	Volume / capacity	litres / pints
	Angle and Distance	Degrees / mm
	Length	mm / inches

MEASURE, SHAPE & SPACE ANSWERS - TASK 2

Instrument	Used to measure?	Unit
	Temperature	Degrees celsius
	Angle	Degrees
	Distance	Metres

In construction we mainly use **metric units** for measuring. Where have you come across the metric units below at work?

Fill in examples of where you have come across that unit in work.

MEASURE, SHAPE & SPACE ANSWERS - TASK 2

METRIC UNITS

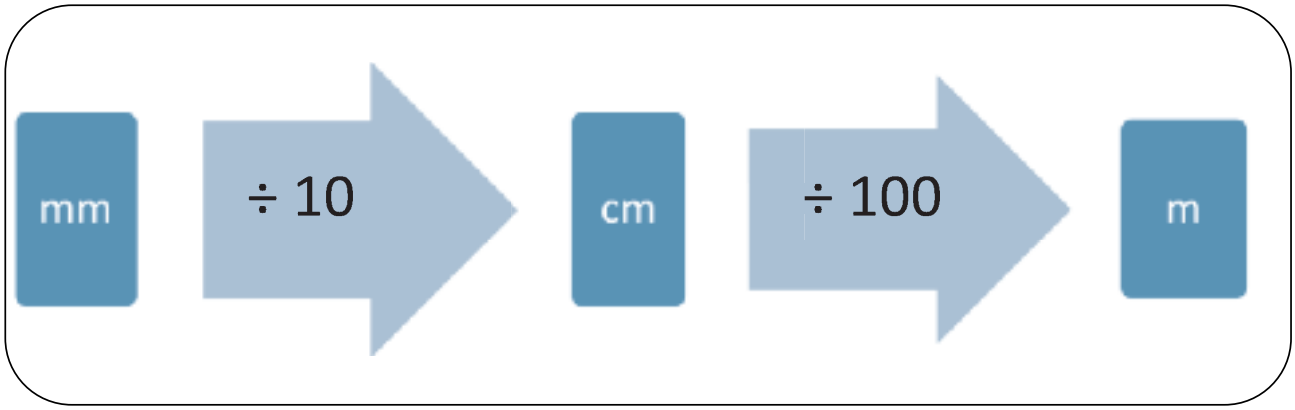
	ABBREVIATION	FULL NAME	EQUIVALENT	EXAMPLES
MEASUREMENT OF LENGTH	mm	millimatre	10 mm = 1 cm 1 000 mm = 1 m	
	cm	centimetre	100 cm = 1 m	
	m	metre	1 000 m = 1 km	
	km	kilometre	1 000 m = 1 km	
MEASUREMENT OF WEIGHT	g	gram	1000g = 1 km	
	kg	kilogram	1kg = 1000g	
	t	tonne	1t = 1000kg	
MEASUREMENT OF CAPACITY	ml	millilitre	1l = 1000ml	
	l	litre	1l = 1000ml	

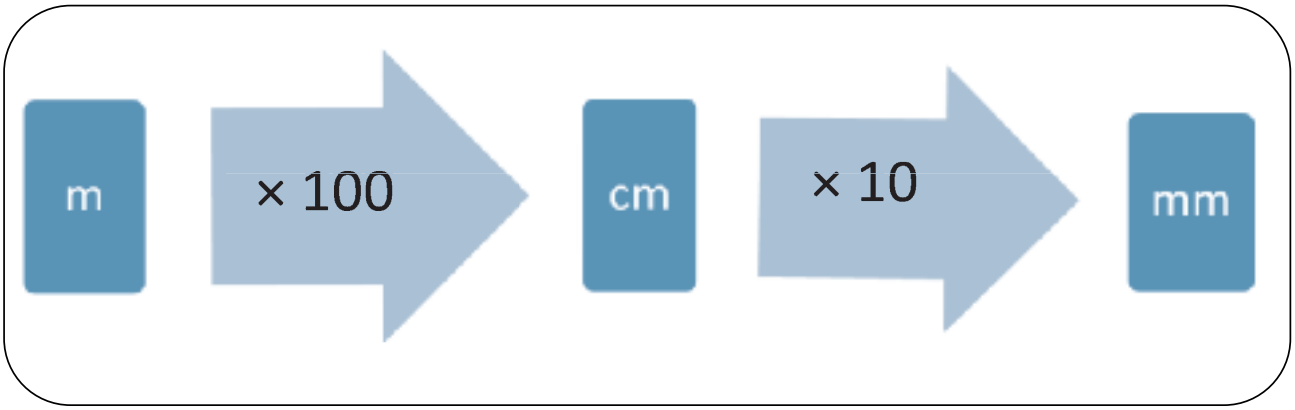
MEASURE, SHAPE & SPACE ANSWERS - TASK 3

CONVERTING BETWEEN METRIC UNITS OF MEASURE

On site most measurements are in metres but when moving down into detail you will need to be able to convert into millimetres.

Worktops are to be fitted in a joinery workshop. The worktop comes in 5m lengths but the site plans showing the layout of the benches have the measurements in mm. When you take the actual measurements on site these will need to be converted.





EXAMPLES

700mm = 70cm	*700 ÷ 10 = 70*
1200mm = 1.2m	*1200 ÷ 1000 = 1.2*
1.3m = 1300mm	*1.3 × 1000 = 1300*

MEASURE, SHAPE & SPACE ANSWERS - TASK 3

Rulers and tape measures are marked off in cm

1. The arrow is pointing at what measurement? (give your answer in cm and in mm)

1.1cm = 11mm

2. The arrow is pointing at what measurement? (give your answer in cm and in mm)

2.5cm =25mm

3. The arrow is pointing at what measurement? (give your answer in cm and in mm)

0.8cm =8mm

MEASURE, SHAPE & SPACE ANSWERS - TASK 3

4. The arrow is pointing at what measurement? (give your answer in cm and in mm)

4.3cm = 43mm

5. The arrow is pointing at what measurement? (give your answer in cm and in mm)

3.7cm = 37mm

6. You have to cut skirting to measure 1010mm. If your tape measure is in cm, what length is 1010 mm in cm?

101cm

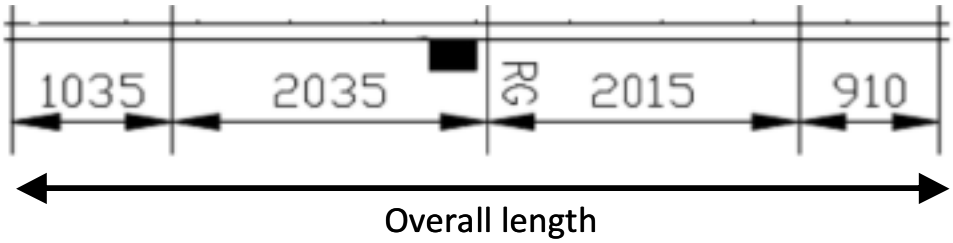
7. A length of pipe needs to be 1570mm long. What is this length in metres?

1570 ÷ 1000 = 1.57m

MEASURE, SHAPE & SPACE ANSWERS - TASK 4

SITE PLANS

Karen works for a construction firm and needs to be able to translate the measurements from the plans she has been given to actual lengths on site. This requires her to accurately measure lengths on the drawings and interpret what these lengths mean on the site. Look at the plans below and check your understanding of site plans.



1. What is the overall length of this section of the site?

1035 + 2035 + 2015 + 910 = 5995mm

2. What is 2035mm in metres?

2.035m

3. The architect thinks he has made a mistake and the 2035mm measurement should be 2.35m. Are these two measurements different? If so, what is the difference?

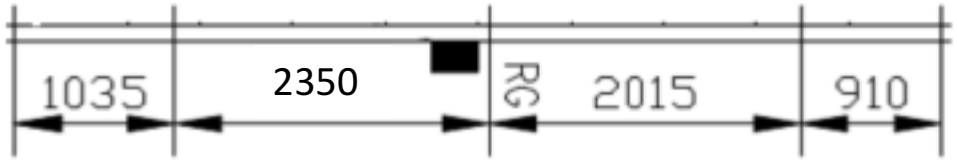
2.35 m = 2350mm

2350 – 2035 = 315mm

the difference is 315mm

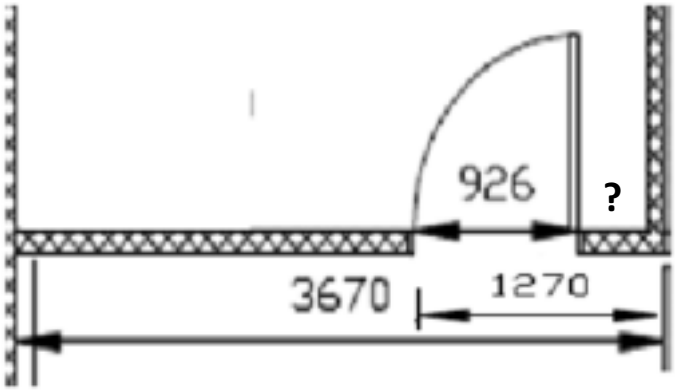
MEASURE, SHAPE & SPACE ANSWERS - TASK 4

The plan is changed to incorporate the changed measurement.



4. Calculate the overall length now.

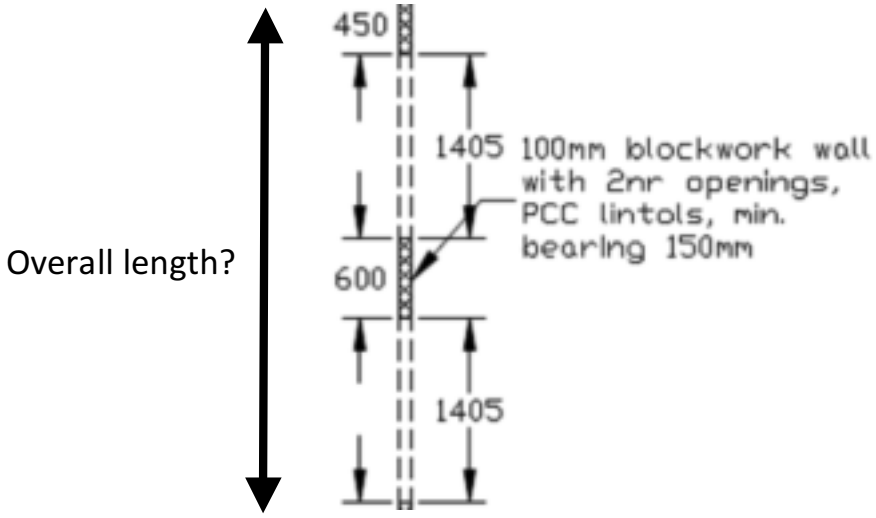
1035 + 2350 + 2015 + 910 = 6310mm



5. There is a measurement missing from the plan above. What is the missing measurement?

1270 - 926 = 344mm

MEASURE, SHAPE & SPACE ANSWERS - TASK 4



6. What is the total overall length shown by the arrow?

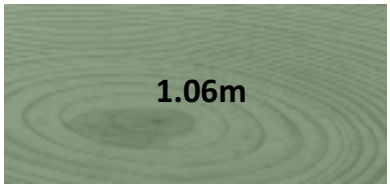
450 + 1405 + 600 + 1405 = 3860mm

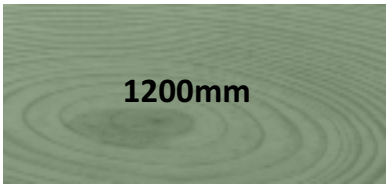
MEASURE, SHAPE & SPACE ANSWERS - TASK 5

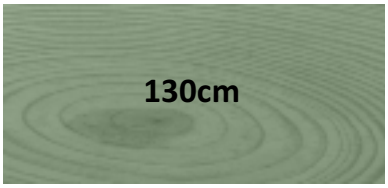
MATERIALS

When working with different materials on site you need to be able to compare quantities such as lengths and weights. From the weight of a steel H-section which will need to be accurately counterbalanced when using a crane on site, to quantities of stone and other building materials, you need to be able to work with metric measurements. Lengths of timber, pipe and steel etc need to be accurately known. Measurements may be given in a variety of units and you need to be able to convert from one unit to another. Test your understanding in the questions below.

1. Put these lengths in ascending order.







1.06m 1200mm 130cm

2. Put these lengths in ascending order.

0.36m 0.4m 0.42m

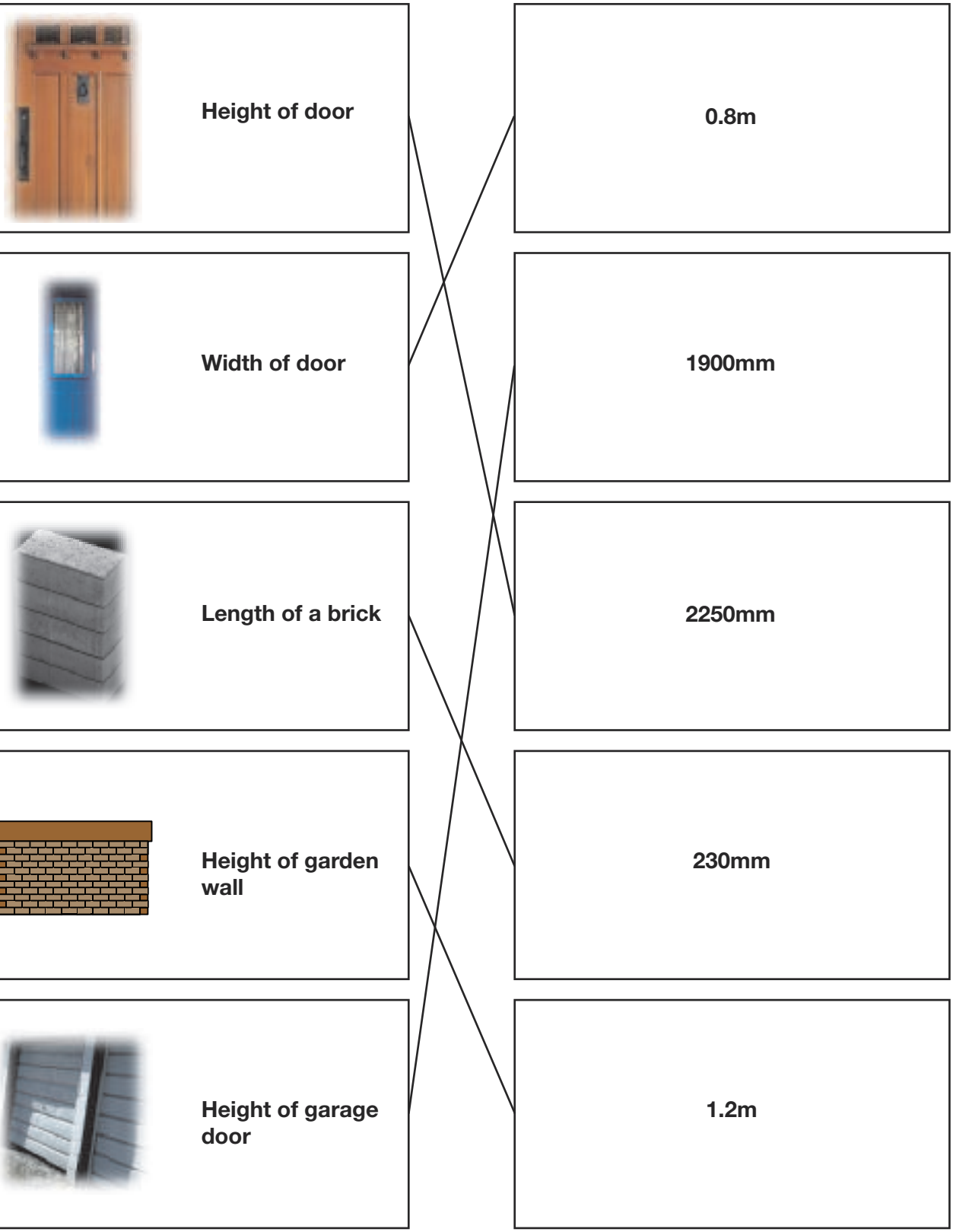
3. Put these weights in order of size.

23.06kg 23.6kg 23500g

23.06kg 23500kg 23.6kg

MEASURE, SHAPE & SPACE ANSWERS - TASK 5

4. Match each of these items to their approximate measurement.

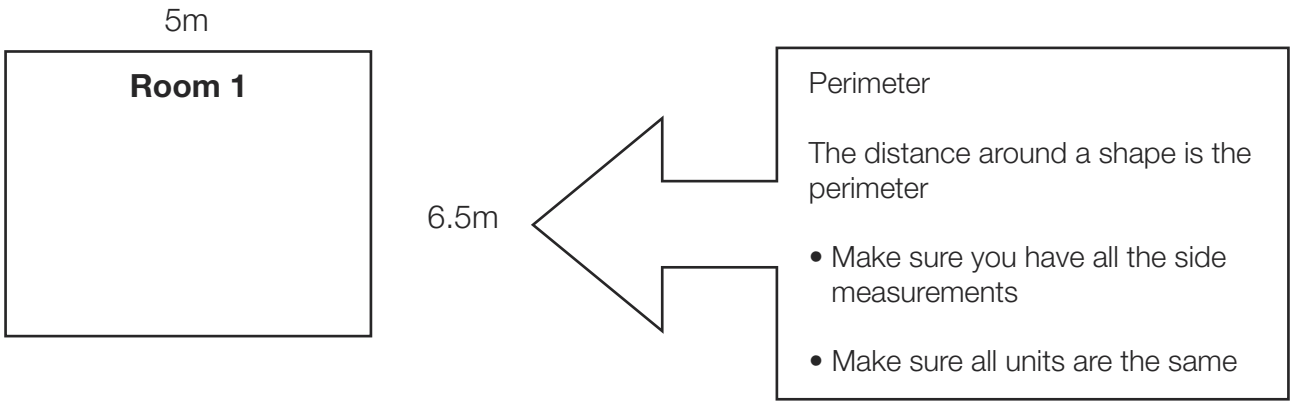


MEASURE, SHAPE & SPACE ANSWERS - TASK 6

PERIMETER

A load of timber skirting has arrived and you are on site and have been asked to lay out the required amount of timber skirting in each room.

To do this you need to be able to calculate the perimeter of the room. But you will also need to remember that skirting comes in 4.2 metre lengths.



1. What is the perimeter of the room?

5 + 5 + 6.5 + 6.5 = 23m

2. If the standard length of skirting is 4.2m how many lengths of skirting will you need to lay out in the room?

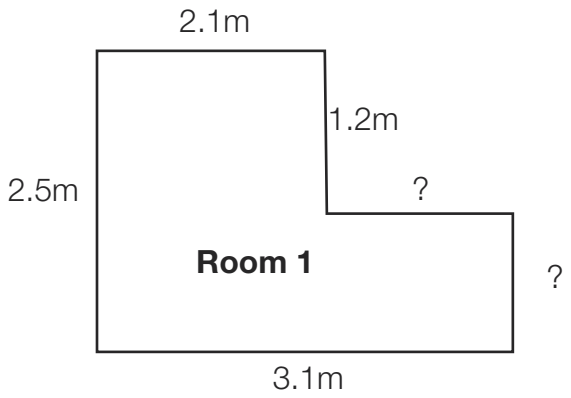
For the 5m side you will need 2 lengths of skirting 4.2m + 0.8m of the second length. This leaves an off cut of 3.4m.

For the 6.5m side you will need 1 length of skirting 4.2m and the remaining 2.3m of wall can use the off cut of skirting left from the 5m side.

This will give a total of three lengths of skirting for these two sides.

Repeat this for the other two sides and you will have to lay out 6 lengths of skirting.

MEASURE, SHAPE & SPACE ANSWERS - TASK 6



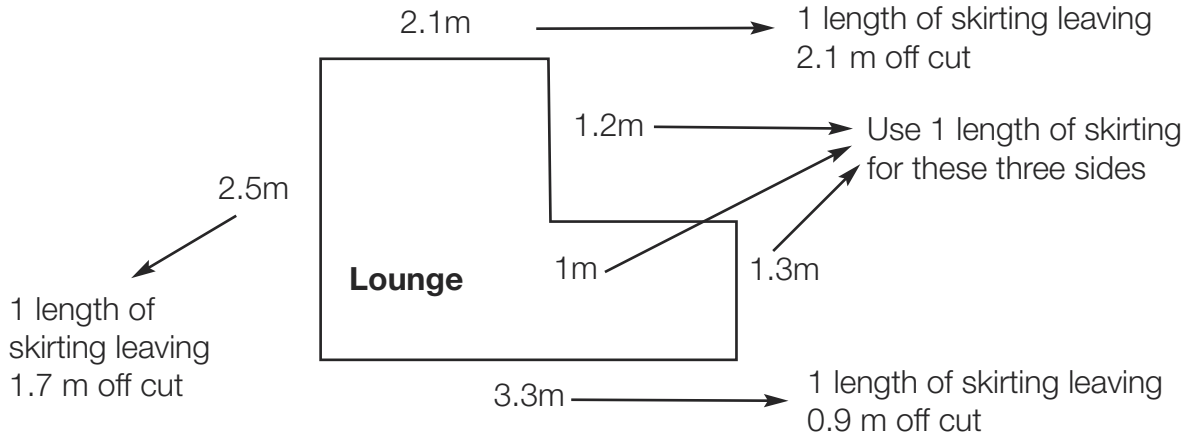
3. What are the lengths of the two sides shown by question marks?

3.1 – 2.1 = 1 m
2.5 – 1.2 = 1.3m

4. What is the perimeter of the room?

2.5 + 2.1 + 1.2 + 1 + 1.3 + 3.1 = 11.2m

5. Remembering that skirting comes in 4.2 m lengths, work out how many lengths you will need to lay out in the room?



This gives a total of 4 lengths of skirting.

6. If you had worked out the amount of skirting needed by dividing the perimeter by 4.2 you would have got 2.6 lengths of skirting (about 3 lengths of skirting). How is this answer different from the answer you got to question 5? Which answer is correct and why?

This is less skirting than we got in question 5. Question 5 gives the correct amount of skirting because when you divide perimeter by 4.2m this gives you the number of lengths of skirting if you are prepared to patch lots of little off cuts together to skirt a wall and this would not be acceptable.

MEASURE, SHAPE & SPACE ANSWERS - TASK 7

AREA

The client would like to get an estimate for a new concrete floor to be put down in an outhouse. In order to calculate the estimate you need to work out the area of the floor. This means taking measurements of the length and width of the floor and converting measurements to metres in order to find the area in squared metres.

length

Area = length x width **width**

Plan of outhouse:

3 m

Outhouse **2.63 m**

What is the area of the room?

2.63 x 3 = 7.89

The area of the room to be floored is:

7.89m^2

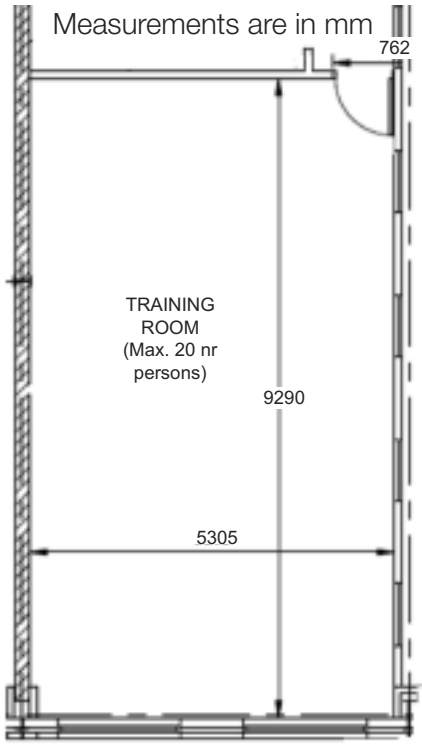
MEASURE, SHAPE & SPACE ANSWERS - TASK 8

PLANS

Measurements can be taken directly from site plans and used in calculations off site.
A site plan is a bird's eye view of a property that is drawn to scale. A site plan can show:

- Property lines
- Outline of existing and proposed buildings and structures
- Distance between buildings
- Distance between buildings and property lines (setbacks)
- Parking lots, indicating parking spaces
- Driveways
- Surrounding streets
- Landscaped areas
- Easements
- Ground sign location

When working from plans you will need to be able to interpret the plans and the measurements on the plans to accurately calculate quantities.



1. From the upstairs plan what is the perimeter of the room in mm?

9290 + 5305 + 9290 + 5305 = 29190mm

MEASURE, SHAPE & SPACE ANSWERS - TASK 8

2. What would this be in metres?

29190 ÷ 1000 = 29.19m

3. What is the width of the door for the training room?

762mm

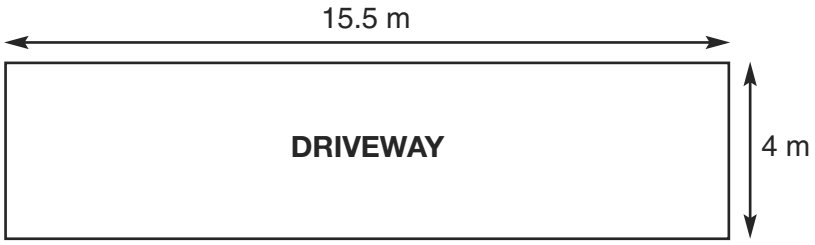
4. What length of skirting would be needed for the room? (remember to leave out the door)

29190 – 762 = 28428mm

MEASURE, SHAPE & SPACE ANSWERS - TASK 9

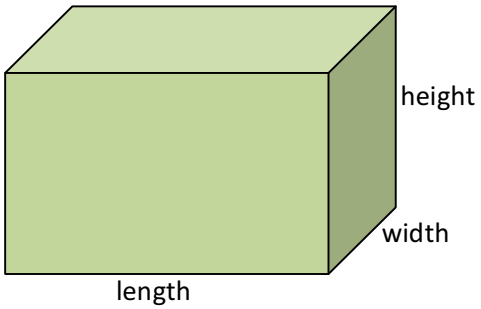
LAYING A CONCRETE DRIVEWAY

RS Contracts have received an order to lay a concrete driveway for a customer. The dimensions of the driveway have been measured as below:



In order to accurately calculate the quantity of concrete required, RS Contacts need to calculate the volume of concrete required. Follow the steps to complete the calculation.

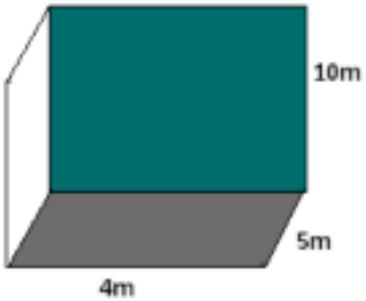
Volume = length × width × height



To order material such as stones for a path or concrete for a driveway or foundations, you need to calculate the volume. Volumes are normally measured in units cubed such as metres cubed.

MEASURE, SHAPE & SPACE ANSWERS - TASK 9

EXAMPLE



For this example the volume is $4 \times 5 \times 10 = 200m^3$

To determine the volume of concrete needed, RS contracts multiply the length and width of the driveway by the depth of concrete to be laid, in this case 100mm.

1. What volume of concrete will they need to order?

Length of driveway in metres = 15.5m

Width of driveway in metres = 4m

Depth of concrete in METRES = 0.1m

Volume of concrete = 15.5 x 4 x 0.1 = $6.2m^2$

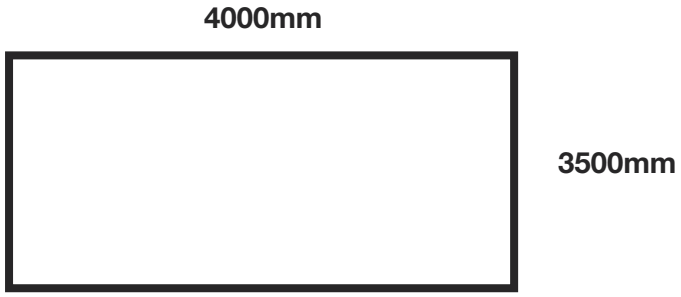
2. As a general rule: one cubic metre of concrete weighs around 2.5 tonnes. Using this method, how many tonnes of concrete will you need to order?

a. Using your answer to question 1 **6.2 × 2.5 = 15.5 = 15.5 tonnes**

MEASURE, SHAPE & SPACE ANSWERS - TASK 10

ERECTING A SHED

You need to build a raft for an NIE substation. The excavation has already been completed and the hard core levelled. You now need to erect the shuttering for the base.



1. What are the dimensions of the concrete base in metres?

4000mm = 4m

3500mm = 3.5m

2. If the concrete for the base needs to be 225mm thick what volume of concrete will be needed in metres cubed?

REMEMBER: ***Volume = length × width × height***

Length in m = 4m

Width in m = 3.5m

Height in m = 0.225m

Volume = 3.15m^3

3. Concrete costs approximately £60 per metre cubed including VAT. What will the cost be for the concrete?

3.15 × 60 = 3.15 × 10 × 6 = 31.5 × 6 = £189

MEASURE, SHAPE & SPACE ANSWERS - TASK 10

4. There are three sizes of lorry that can deliver concrete.

Lorry A can carry $3m^3$ of concrete

Lorry B can carry $5m^3$ of concrete

Lorry C can carry $7m^3$ of concrete

Which is the most cost effective lorry to use?

$3.15m^3$ of concrete needed – so we will need to use Lorry B which can carry $5m^3$ of concrete.

5. If two substation bases need to be built what is the total volume of concrete needed?

$3.15 \times 2 = 6.3m^3$

6. Remembering that there are three sizes of lorry that can deliver concrete.

Lorry A can carry $3m^3$ of concrete

Lorry B can carry $5m^3$ of concrete

Lorry C can carry $7m^3$ of concrete

Which is the most cost effective lorry to use to deliver the concrete for the two substation bases? What volume of concrete will be left over from the lorry load?

$6.3m^3$ of concrete needed. Therefore you will Lorry C which can hold $7m^3$. This leaves $0.7m^3$ of concrete.

MEASURE, SHAPE & SPACE ANSWERS - TASK 10

7. How could this wastage be used? – suggest what it could be used for on site.

The wastage could be used to create:

- lintels in substructure work
- hard standing elsewhere on site
- bollards to increase security on site

MEASURE, SHAPE & SPACE ANSWERS - TASK 11

BRICK WALL

James has been working on a residential development for McClarty construction and is to build a small wall in front of one of the properties. This will be the first time he has undertaken a project from start to finish. He needs to do a range of calculations for instance the amount of brick, mortar, concrete etc. required to complete the job. The task below will take him through the various stages of each calculation.

Each brick measures:

21.5 cm x 10.25 cm x 6.5 cm

1. What are the dimensions of the brick in mm?

215mm by 102.5mm by 65mm

The first bricks have been laid as shown above.

2. If the thickness of mortar is 10mm. What is length of the wall so far?

16 bricks × 215 = 3440mm

15 × 10 = 150mm

Total = 3590mm

3. Mortar is made up from 1 part cement to 4 parts sand.
How much sand would be needed to mix with 2 buckets of cement?

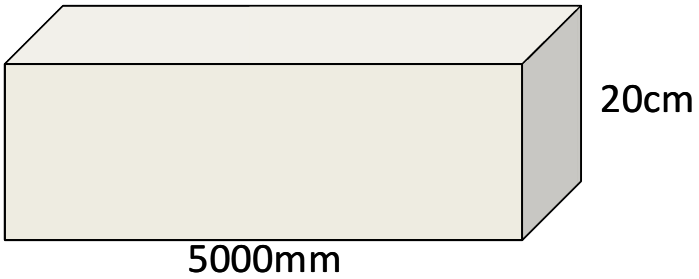
1 part cement	**to**		**4 parts sand**
2 buckets of cement	**to**	8	**buckets of sand**

MEASURE, SHAPE & SPACE ANSWERS - TASK 11

4. When the wall around the garden is completed it will contain 120 bricks. Each brick costs 40p. How much will all the bricks required for the wall cost?

120 × 40 = 4800p = £48

For a small garden wall, a foundation is dug as shown below.



The width of the foundation is twice the width of a brick plus 10mm.

5. If a brick is 102.5mm wide, what will the width of the foundation be?

102.5 × 2 = 205mm

205 + 10 = 215mm

MEASURE, SHAPE & SPACE ANSWERS - TASK 11

6. What are the dimensions of the foundation in metres?

Length = 5m

Width = 0.215m

Height = 0.2m

7. What volume of concrete will you need for the foundation?

Volume of cuboid =

length × width × height

5 × 0.215 × 0.2 = 0.215

Volume of concrete = 0.215m^3

8. The concrete for the foundation is made up 1 part cement: 3 parts sand : 5 parts 10mm aggregate. If you have 8 buckets of cement, how many buckets of sand and aggregate will you need?

1 part cement	:	3 parts sand	:	5 parts 10mm aggregate
8 buckets of cement	:	24 buckets	:	40 buckets

MEASURE, SHAPE & SPACE ANSWERS - TASK 12

MAPS

Chris lives in Newry and is a construction engineer for a large local firm. He has to make a visit to three of the company's sites tomorrow. The first site is in Ballycastle and Chris is trying to work out how far away it is. He takes out a map similar to the one you see below and begins to estimate the distance from Newry to Ballycastle.

1. Use a ruler to estimate the distance "as the crow flies" from Newry to Ballycastle if the map has a scale of 1cm to 4.5 miles.

Round the ruler measurement to the nearest cm

Less than 9.5cm so rounds to 9cm

Convert this to miles using the scale given above

9 x 4.5 = 40.5 miles

MEASURE, SHAPE & SPACE ANSWERS - TASK 12

Chris realises this method is not very accurate so he attempts to use a slightly different approach. He breaks the journey into three “as the crow flies” legs.

- Newry to Belfast
- Belfast to Ballymena
- Ballymena to Ballycastle

2. Use the map again to calculate an improved estimate of the distance from Newry to Ballycastle and show your working in the space below

Newry to Belfast:
Ruler measurement in cm

Circle one option 4.0cm (4.5cm) 5.0cm

Belfast to Ballymena:
Ruler measurement to nearest cm

Circle one option (3.0cm) 3.5cm 4.0cm

Ballymena to Ballycastle:
Ruler measurement to nearest cm =

Circle one option (3.0cm) 3.5cm 4.0cm

Add up the three measurements:

Total journey in cm = 4.5 + 3.0 + 3.0 = 10.5cm

Total journey in miles = 10.5 x 4.5 = 47.25 miles

MEASURE, SHAPE & SPACE ANSWERS - TASK 12

3. Round your answer above to the nearest 5 miles.

47.25 = 45miles to the nearest 5 miles

An internet search on www.multimap.com for this journey gives an answer of 92 miles.

4. Round this figure to the nearest 5 miles

92 = 90 miles to the nearest 5 miles

The difference in the previous two answers could be described as the error in Chris's method.

5. What is the error in miles?

90 – 45 = 45 miles

MEASURE, SHAPE & SPACE ANSWERS - TASK 12

6. Which of the following answers do you feel best describes the percentage error in Chris's method? Don't do any further actual calculations to answer this.

Error in miles = 45 Correct answer in miles = 90

Circle one option

10% 33% (50%) 100%

Reason:

45 is half of 90 and ½ = 50%

After Chris visits the Ballycastle site he has to go to Magherafelt where his company are upgrading the spectator seating at a local rugby ground. From Magherafelt he will travel to a site in Armagh where his company are building a new shopping centre. After that he will go back to Newry.

7. Use the mileage chart below to calculate how far Chris will have travelled altogether by the time he returns home again in the evening.

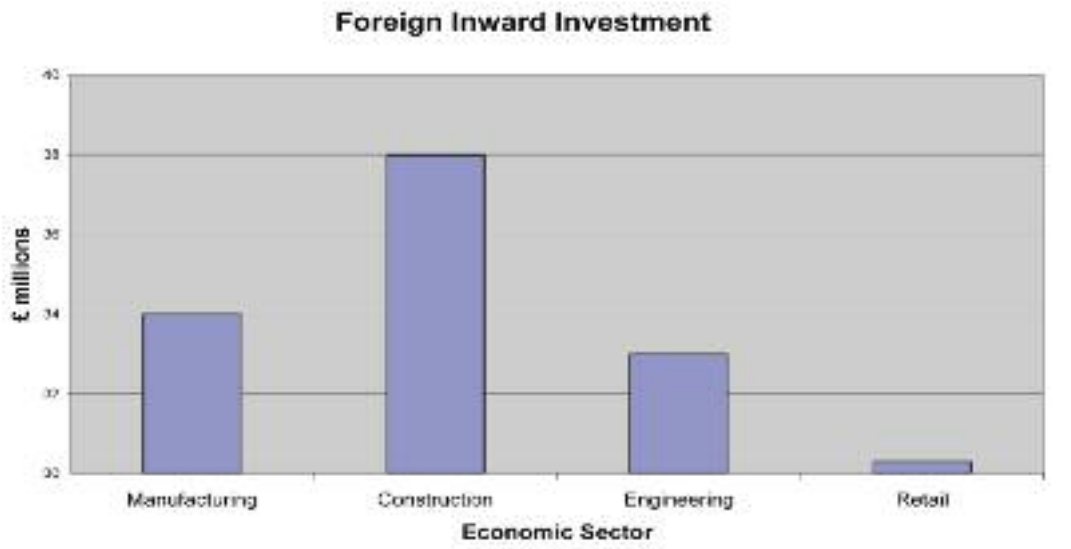
	Armagh	Ballycastle	Magherafelt	Newry
Armagh		95	33	19
Ballycastle	95		52	92
Magherafelt	33	52		51
Newry	19	92	51	

Mileage covered in total:

92 + 52 + 33 + 19 = 196 miles

MEASURE, SHAPE & SPACE ANSWERS - TASK 12

He arrives in Ballycastle just as the workers are having a tea break. Bill and Malachy are having a conversation about an article in the newspaper. The article includes the chart shown below.



Bill says Construction has received twice as much investment as manufacturing. Malachy agrees and thinks the retail sector has received very little indeed.

8. Comment on these statements in the space below.

Construction recieved twice as much as manufacturing:
Construction bar is twice as long as Manufacturing hence Bill's error as the axis does not start at 0.

Retail sector received very little:
Relative to other bars the Retail bar looks insignificant. However in reality over £30 million has been invested in that sector but the axis not starting at 0 is misleading at a glance

MEASURE, SHAPE & SPACE ANSWERS - TASK 12

There is an article is this paper about the rugby ground Chris's company are in the process of upgrading. The article states that the finished stadium is to have a seating capacity of 380,000 people and that 15,000 tonnes of concrete will have been used in the construction of it. According to the article the project was initially tendered at a cost of £18,000,000 but is due to come in over budget by 50% making the final total £18,900,000.

9. State whether or not you think these statistics are reasonable and if not indicate what may be wrong.

Capacity of 380,000 people

Too large by a factor of 10. 38,000 is a much more realistic figure.

15000 tonnes of concrete

Reasonable

£18,000,000 increased by 50% gives £18,900,000

Miscalculation: 50% of 18,000,000 is £9,000,000 and not £900,000 giving £27,000,000 instead of £18,900,000

MEASURE, SHAPE & SPACE ANSWERS - TASK 13

RENOVATION

John is going to put down a concrete floor and replace the beams in an old barn his company is developing. He takes some measurements with a tape and finds the barn floor is rectangular with dimensions 4.45m by 3.92m

1. Round these values up the nearest metre in order to make the volume calculation easier and allow for some wastage.

4.45m rounded up is	5m
3.92m rounded up is	4m

John knows the floor must be at least 3” deep so he decides to use 4” in his calculations to ensure he orders enough concrete and because he knows that 4” comes out at a round number when converted to cm. What is the number he is thinking of?

2. First of all use the fact that 1” = 25mm to convert to mm.

1” = 25mm so 4” = 4” = 4x25 = 100mm

3. Now convert this answer to cm.

10mm = 1cm

100mm = 10cm

MEASURE, SHAPE & SPACE ANSWERS - TASK 13

After doing the volume calculation he rings up to order 200m^3 of concrete. The person on the phone asks him if he is sure as that is a very large amount of concrete.

4. Is John correct? If not show how he went wrong in his calculation?

Remember Volume = length x width x height

No he is not correct. John calculated = 5 x 4 x 10 = 200 because he forgot to change 10cm to 0.1m before doing his calculation. He should have got 2m^3.

John also wants to use steel for the main beams. The table below gives some information on the price of steel beams according to their strength.

Beam Type	Max. load per metre in tonnes	Price (£)
A	1.2	80
B	1.8	120
C	2.4	160
D	3.0	200
E	4.8	320

5. Use the figures given to help fill in the unknown prices. If you need to do some calculations use the space below the table:

MEASURE, SHAPE & SPACE ANSWERS - TASK 13

Cameron is making a batch of mortar for John to finish some work behind the barn. Mixing sand and cement in different ratios helps produce different kinds of mortar.

A very hard mix as might be used for a floor would use 3:1 of sand to cement. A softer mortar mix such as is used for brickwork might use 6:1.

Cameron is making up a mix using the ratio 4:1 sand to cement. He has a 5 kg bag of cement.

6. How much sand does he need?

He needs 4 x 5 = 20kg of sand.

7. How much mortar mix will this make altogether?

5 + 20 = 25kg

Later Cameron is asked to make 50kg of mortar mix to the same hardness as the last batch. He wonders if there is a short cut to working out how much sand and cement to use for this batch.

8. Help give Cameron an answer in the space below.

By direct proportion if 25 kg needs 20kg of sand and 5kg of cement

then 50 kg needs 40kg of sand and 10kg of cement

Handling Data
Tasks and Answers

This section mainly addresses the curriculum area specified, although to allow a more realistic setting for each task, some elements from other curriculum areas may also mentioned.





HANDLING DATA TASK 1

THE CONSTRUCTION INDUSTRY

Statistics in the construction sector allow changes and trends to be analysed. They give a perspective of trends in the construction industry in Northern Ireland and allow some international comparisons. It also helps to determine initiatives that may influence the future.

Statistics can be used by insurance companies to set premiums.

For businesses, statistics allow them to forward plan by looking at current trends.

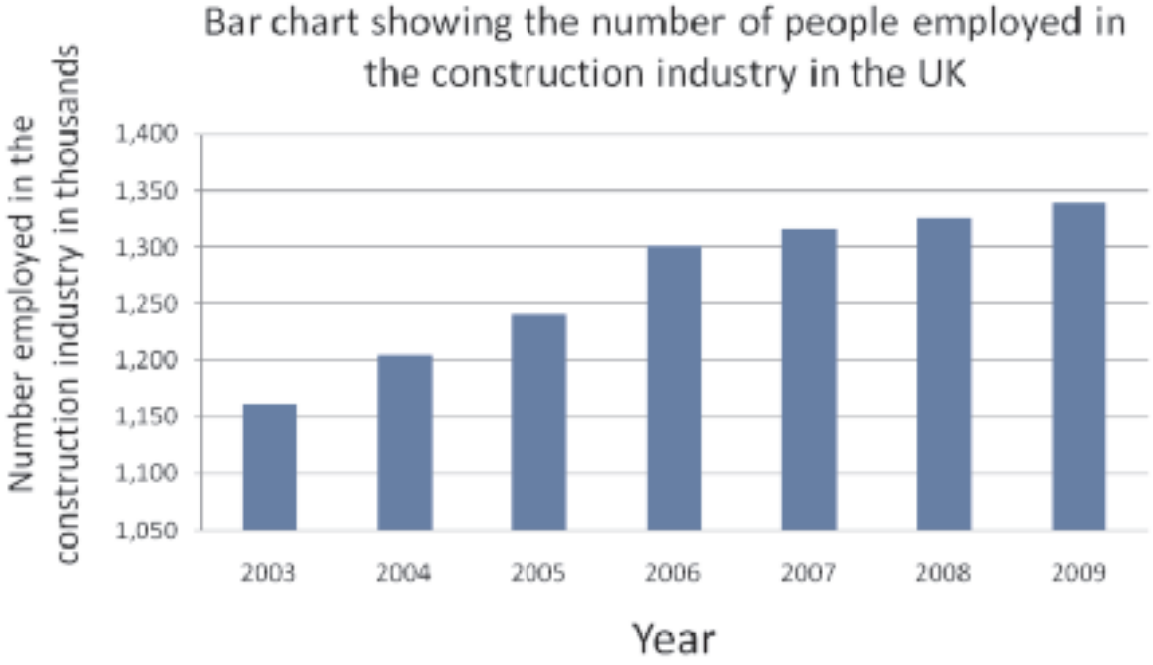
BAR CHARTS

Remember that bar charts are one way of displaying information.

When you draw a bar chart, you need to decide what it is you want your chart to illustrate. Then you need to consider

1. What will the title be?
2. How many bars will you need?
3. What scale will you need for the other axis?
4. Draw and label the two axes.
5. Draw the bars.

Look at the bar chart below taken from http://www.statistics.gov.uk



HANDLING DATA TASK 1

Section 1

Look at the information in the chart on the construction industry from the source material. Decide whether these statements are true or false.

1. The bar chart shows how many people were employed in the construction industry in Northern Ireland from 2003 to 2009.

   True / False

2. One thousand three hundred people were employed in the construction industry in 2006.

   True / False

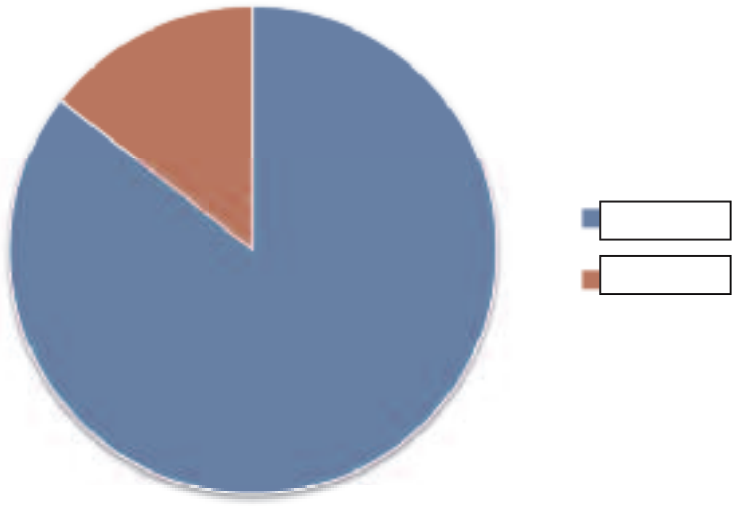
3. The biggest increase in the number of people employed in the construction industry was seen between 2005 and 2006.

   True / False

PIE CHARTS

Pie charts are useful to compare different parts of a whole amount. Pie charts are circles divided into segments, where each segment represents a fraction of the total amount.

The pie chart below shows the proportion of males and females employed in the construction sector in the UK in 2009.



HANDLING DATA TASK 1

Section 2

Look at the information in the pie chart.

1. What labels should go on the right hand side? Write your answer on the chart.

Decide whether these statements are true or false.

3. There are more males than females employed in the construction sector in 2009.

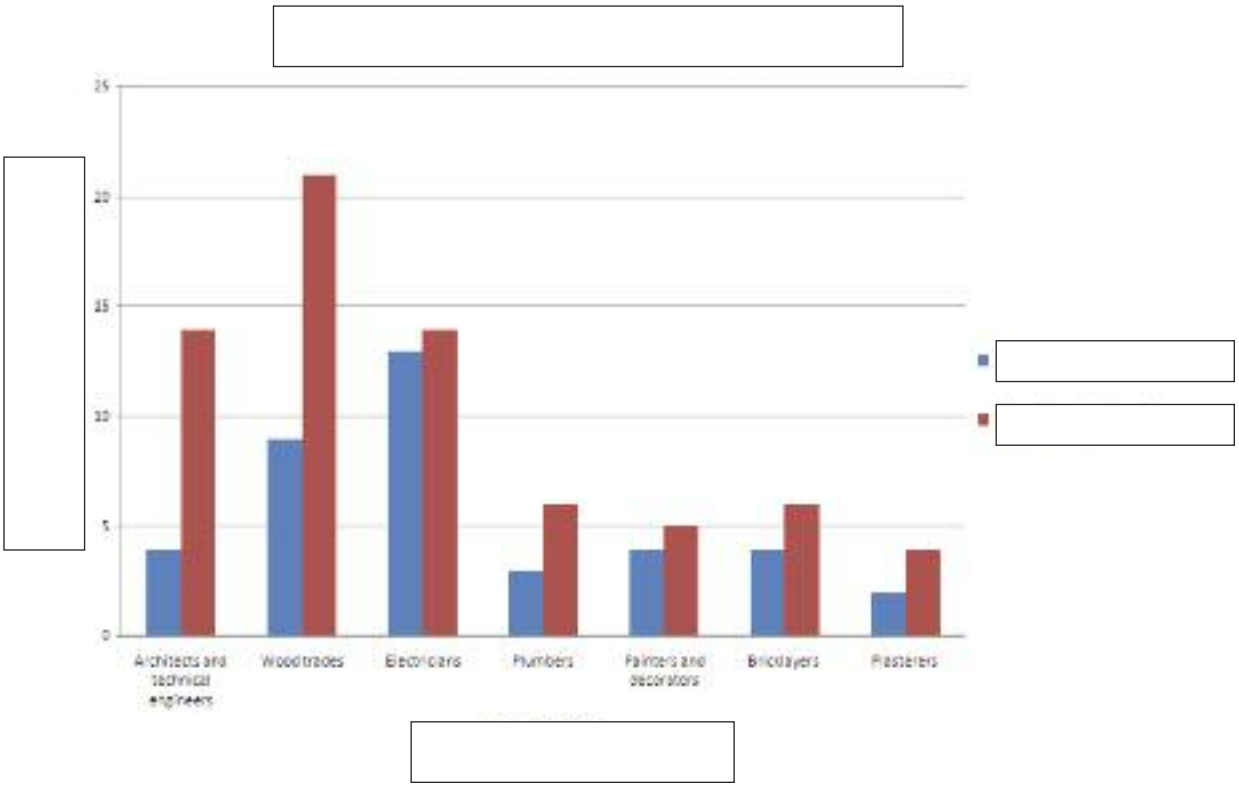
True / False

3. About one quarter of the total people employed in the construction industry is female.

True / False

COMPARISON BAR CHART

The **Comparison bar chart** is used when we want to represent two sets of data on the same chart. We can put the bars side by side or we may put the bars of one set of data on top of the bars of the other set of data.



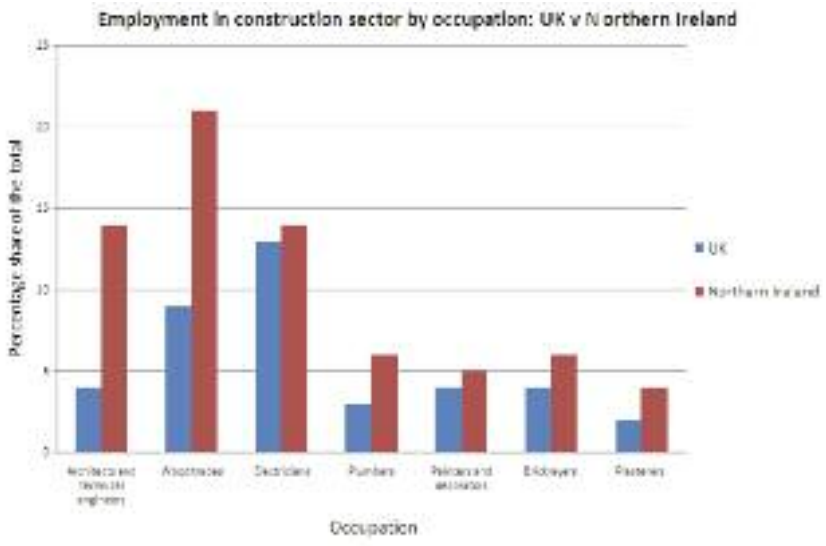
HANDLING DATA TASK 1

Section 3

When the comparison bar chart was drawn the labels were missing. They are below. Can you write in where they should be on the chart?

Number employed in the construction industry in the UK in thousands	Males	Females
Year	Chart showing the numbers of males and females employed in the construction industry.	

Did your chart look like this?



Look at the information in the comparison bar chart. Decide whether these statements are true or false.

1. The percentage of people employed in the construction sector as plumbers is greater in the UK than in Northern Ireland.

   True / False

2. The percentage of people employed in the construction sector as architects / technical engineers is greater in Northern Ireland than in the UK.

   True / False

3. The percentage of people employed in the construction sector as electricians is approximately the same in both regions.

   True / False

HANDLING DATA TASK 2

THE WORKFORCE

It is important for a company to monitor the makeup of their workforce both those directly employed by the company and also any subcontracted staff. This allows them to identify areas where there may be a high turnover of staff or where it has been difficult to get suitable qualified employees. Where there is a skill shortage companies need to forward plan. This may mean diversifying the skills of current employees to meet the shortage in the longer term.

Managers	15
Engineers	8
Drivers	15
Road Operatives	42
Quarry Operatives	13
Other	27

1. Display this information on a Bar chart.

HANDLING DATA TASK 2

The average is a typical value. In the next section when we talk about average we are talking about mean. There are other types of average but we want to look at mean. It is easy to calculate: Just add up all the numbers, then divide by how many numbers there are.

$$Mean = \frac{Total}{Number\ of\ values}$$

The engineers worked the following hours last month:

181	203	217	184
179	221	233	165
194	0		

2. What is the mean number of hours worked last month by the engineers?

Total hours worked by all 10 engineers =

Mean number of hours worked = Total hours worked ÷ number of engineers

3. What is the range of hours worked last month by the engineers?

HANDLING DATA TASK 2

4. A new engineer joined the company this month and she worked 204 hours. What is the mean number of hours worked this month by the engineers if the others worked the same number of hours as in the previous month?

Total hours worked by all 11 engineers =

Mean number of hours worked = Total hours worked ÷ number of engineers

5. What is this figure rounded to the nearest hour?

6. How has the arrival of the new employee affected the mean number of hours worked?

7. How has the range of hours worked been affected?

HANDLING DATA TASK 3

AVERAGE AND RANGE

Averages look at what we mean when we think of the "typical" value in a collection of data. The concept is extremely important and we encounter it frequently in construction, because we regularly work with numerical quantities. For example, the average number of bricks needed for a wall with particular dimensions or before accepting a job, you might want to know what a typical salary is for someone in that position. The concept of "typical" or "average" is an important one in the construction sector.

Mean

The ***average*** is a typical value. In this section when we talk about average we are talking about ***mean***. There are other types of average but we want to look at mean.

It is easy to calculate: Just ***add up*** all the numbers, then ***divide by how many*** numbers there are.

$$\text{Mean} = \frac{\text{Total}}{\text{Number of values}}$$

Example

The lengths of off cuts of wood in a workshop are:

400mm 200mm 150mm 330mm

To find the average (mean) length of wood we:

Total = 400 + 200 + 150 + 330 = 1080mm

Number of values = 4

$$\text{Mean} = \frac{1080}{4} = 270\text{mm length}$$

Check your answer is correct by doing the reverse calculation. 270 × 4 = 1080

1. Four site operatives earn £6.50 an hour and the site foreman earns £15 an hour. What is the mean wage?

HANDLING DATA TASK 3

2. Does this wage represent the salaries that those on the site earn i.e. is it a typical value?

3. The ages of site operatives on a particular building site are:

23 35 28 35 41 21 20

What is the average (mean) age?

4. Employees at a builder's yard are paid the hourly wages listed below. What is the mean hourly wages?

£5.15, £8.95, £5.75, £5.50, £5.25, £5.40.

HANDLING DATA TASK 3

Range

The range is the difference between the highest and lowest values in a set of numbers. It tells you how spread out the values are.

To find it, **subtract the lowest number in the set of numbers from the highest**.

Range = highest value – lowest value

Example

The ages of students on work experience are shown below. What is the range in ages?

16 17 19 17 18 16 23 30

Range = highest value – lowest value

Range = 30 – 16 = **14 years**

HANDLING DATA TASK 3

5. The prices for a tape measure are shown below. Find the price range?

You are Here: Home > **Search for 'Tape Measures'** > Comparison

Product Comparison

You have selected these products to compare. To remove a product click the ■ icon. Print this Page Back to Search Results	Enlarge Image  Stanley FatMax XL Tape Measure 5m (16') Add to Trolley	Enlarge Image  Stanley Power Rule 10m/33' Add to Trolley	Enlarge Image  Forge Steel Long Steel Tape 30m x 13mm Add to Trolley	Enlarge Image  Stanley Fatmax XL Tape Measure 10m Add to Trolley
Quote	53060	24359	87866	29041
Price (Inc. VAT)	£18.84	£17.79	£9.99	£25.65
Brand	FATMAX XL	Stanley	Forge Steel	FATMAX XL
Model No.		0-33-443		
Description	5m (16ft). Blade armour protection on first 6" for resistance to breakage on susceptible areas. 32mm wide blade for easy reading. Blade hook grabs on top or bottom for versatility.	Highly accurate, professional Tape Measure. Metric and imperial. Spring return mechanism and 3 rivet 'tru-zero' hook for accurate readings.	30m x 13mm.Tape coated with acrylic polymers. Easy-to-read bold black numbers.	10m (33'). Blade armor protection on first 6". 32mm wide blade for easy reading. Blade hook grabs on top or bottom.

HANDLING DATA TASK 3

6. Employees at a builder's yard are paid the hourly wages listed below. What is the range of these hourly wages?

£7.50, £9.25, £8.75, £9.50, £7.25, £8.50.

7. The hours worked on site for 5 employees are shown below. What is the range of hours worked and what is the mean number of hours worked.

36 32 40 39 38

HANDLING DATA TASK 3

A building contractor employs 10 construction tradespersons on a full-time basis. All skilled construction trade employees are paid the same basic annual salary of £25,250. As managing director he pays himself an annual salary of £99,500. He is looking to take on another full-time bricklayer and advertises in the jobs section of a trade publication. The advertisement claims that the average salary in the company is £32, 000.

8. Is this claim correct?

Total salary bill for company for 10 tradespersons and the managing director

=

Mean salary = Total salary ÷ 11

=

9. Is this advertisement fair? If not why not?

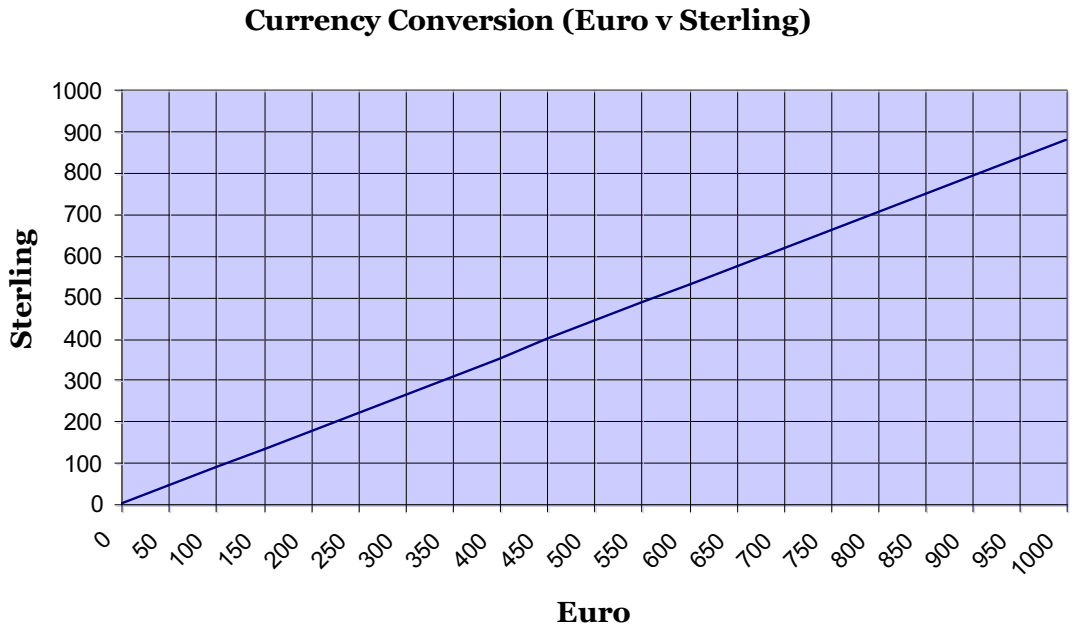
HANDLING DATA TASK 4

BUILDING TRADE

The following table shows the volume of sales revenue (£000's) last year for five building supplies businesses chosen at random in Northern Ireland, Republic of Ireland and England.

Northern Ireland (£)	Republic of Ireland (€)	England (£)
356	203	215
413	645	6305
167	909	451
48	396	87
192	302	0
Total	Total	Total

1. Use the conversion graph below to convert the figure for Republic of Ireland from € to £ so a comparison can be made.



2. Did you convert each value individually or did you use an alternative method?

3. Now complete the table above so the totals are in £.

HANDLING DATA TASK 4

4. Calculate the mean revenue for building supplies businesses in the separate regions.

Northern Ireland

Total revenue =

Mean = Total revenue ÷ 5 =

What does the displayed by your calculator mean in terms of money?

Republic of Ireland

Total revenue =

Mean = Total revenue ÷ 5 =

What does the displayed by your calculator mean in terms of money?

England

Total revenue =

Mean = Total revenue ÷ ? =

What does the displayed by your calculator mean in terms of money?

HANDLING DATA TASK 4

5. Determine an all-Ireland national average (mean) and compare it to the figure you already have for England.

All-Ireland

Total revenue =

Mean = Total revenue ÷ ?

Compare:

6. Which region had the largest range in revenues last year according to the data in the table above?

If you are able to answer this without having to do any calculations please explain why:

HANDLING DATA TASK 5

CONSTRUCTION MACHINERY

On site you will encounter a wide range of plant machinery from dozers to excavators to loaders and lorries. Each has a specific function on site and that function will determine the design and specification of the vehicle. Below are cards showing a range of plant machinery and their dimensions. Compare the vehicles and look at the weight, lengths and power of each.

LARGE DOZER

A

Engine power- 259 kW
Max. Operating Weight - 38,488 kg
Overall length - 5.6m
Fuel tank – 643 litres

TRACKED EXCAVATOR

B

Engine power - 124kW
Max. Operating Weight - 20,003 kg
Overall length - 8.37m (Transport length)
Fuel tank – 253 litres

SKID STEER LOADERS

C

Engine power - 52kW
Max. Operating Weight – 2,650 kg
Overall length - 3.27m
Fuel tank – 80 litres

MEDIUM DOZER

D

Engine power - 93kW
Max. Operating Weight – 13,460kg
Overall length - 4.7m
Fuel tank – 295 litres

WHEELED LOADER

E

Engine power – 180kW
Max. Operating Weight – 25,400kg
Overall length - 8.1m
Fuel tank – 210 litres

MOBILE CRANE

F

Engine power – 205kW
Max. Operating Weight – 29,000kg
Overall length - 10.5m (transport position)
Fuel tank – 300 litres

HANDLING DATA TASK 5

DUMP TRUCK

G

Engine power – 246 kW
Max. Operating Weight – 53,140kg
Overall length - 6.9 m
Fuel tank – 410 litres

VIBRATING ROLLER

H

Engine power – 100 kW
Max. Operating Weight – 11,550kg
Overall length - 4.5 m
Fuel tank – 200 litres

ROLLER

I

Engine power – 97 kW
Max. Operating Weight – 11,300kg
Overall length - 5.4 m
Fuel tank – 300 litres

BACKHOE LOADER

J

Engine power – 74.2kW
Max. Operating Weight – 8,660kg
Overall length - 5.9 m
Fuel tank – 160 litres

HANDLING DATA TASK 5

Using the cards for construction machinery, answer the questions below.

1. What is the range of engine powers in the vehicles?

2. Round each of the lengths to the nearest metre.

VEHICLE	LENGTH ROUNDED to nearest metre	VEHICLE	LENGTH ROUNDED to nearest metre
A. Bulldozer		F. Mobile Crane	
B. Tracked Excavator		G. Dump Truck	
C. Skid steer Loaders		H. Vibrating Roller	
D. Medium Dozer		I. Roller	
E. Wheeled Loader		J. Backhoe Loader	

3. For the two dozers (A) and (D), what is the average (mean) engine power?

4. What is the range in lengths of the construction vehicles?

HANDLING DATA TASK 5

5. Work out the order of the cards based on the actual overall length of each vehicle. You don't need to write out the name of each vehicle, simply use the letters on each card A to J.

	Vehicles - smallest to largest overall lengths
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

6. What is the range in lengths of the construction vehicles?

7. What is the range in sizes of the fuel tanks?

8. What is the operating weight of the mobile crane in tonnes?

HANDLING DATA TASK 6

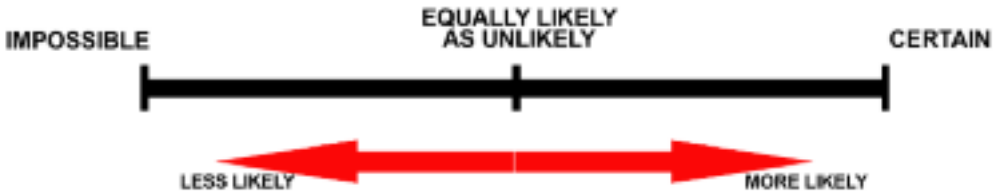
CHANCES ARE

Probability is an area of mathematics used to measure uncertainty. In life the outcome of many events is not predictable but it is possible to get an idea of how likely some things are to happen. Being able to tell how likely something is to happen is very important in construction especially when it comes to health and safety. Insurance companies base their premiums directly on probabilities.

A scale is used to represent probability with “impossible” at one end and “certain” at the other. All other outcomes can be placed somewhere on the scale between these two extremes. Things that are unlikely are placed near the impossible end whilst things likely to happen are placed near the certain end. We can use common sense to place some outcomes on the scale….

1. For example, place the following outcomes on the probability scale below

A. Someone chosen at random from a construction trade is a man
B. Someone who follows all safety guidelines has an accident
C. A mortar mixture will harden if someone forgot to add cement
D. A warm but poorly insulated building will lose heat on a cold day
E. Someone chosen at random from the community is a woman



Sometimes we cannot just tell from common sense how likely an outcome is or whether one outcome is more likely than another. In order to tell if some outcomes are more likely than others we need to represent probabilities using fractions. The top of the fraction is the number of favourable outcomes and the bottom of the fraction is the number of possible outcomes.

$$\textbf{Probability} = \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}}$$

HANDLING DATA TASK 6

2. Complete the following table to help you practice working with different kinds of fractions and then you can try to answer some probability questions.

Fraction	Decimal	Percentage	Outcome description
0			Impossible
	0.1		
		25%	Unlikely
1/2			Just as likely as not to happen
	0.75		
		90%	Very likely
1			

Use the definition of probability given above to determine how probable the following events are to happen.

3. McAteer and Bushe, a local construction company, have purchased 4 brand new lorries. Only one of them has air-conditioning for the cab. If a driver chooses a lorry to drive at random what is the probability it will have air-conditioning.

4. What is the probability it won't have air-conditioning?

HANDLING DATA TASK 6

5. If you have not already done so express your answers to the latter two questions in percentage form.

6. What do you notice about the answers when you add them together?

7. The probability of a lorry breaking down in service is 0.05. Use what you have learned in the previous question to determine the probability that a lorry will not break down in service.

8. Write down a rule to help you find the probability of something not happening if you already know the probability of it happening.

HANDLING DATA TASK 7

HEALTH AND SAFETY

As mentioned in the previous task, one important use of probability in the construction sector is linked to the management of health and safety. You can now try to apply what you have learned above to the following scenario:

A Safety at Work study (figures not official) has been carried out for the construction industry. It has been determined there is a 1% chance an operative (18-65 years old) will have an accident whilst driving machinery.

1. What is the probability that an operative will not have an accident whilst driving machinery?

2. If 1% of the 30000 operatives working in Northern Ireland have an accident when using machinery, how many would that be?

HANDLING DATA TASK 7

The study also looked at safety of pneumatic drills and found that there is a 1 in 50 (that's 2%) chance an operative will have an accident whilst using one.

3. Which of the activities appears to be more accident prone, driving machinery or using a pneumatic drill?

Of the 30000 operatives referred to above, 1500 of them are over 50 years old.

4. What is the probability that an operative is over 50?

There are ten different tasks given to operatives in one company. Five involve driving machines, two involve using pneumatic drills and three involve the use of hand tools.

5. What is the probability an operative will be given a task involving a hand tool?

HANDLING DATA TASK 7

6. What is the probability that the operative will NOT be given a task involving a hand tool?

7. What is the probability that the operative will be given a task involving use of a pneumatic drill?

HANDLING DATA ANSWERS - TASK 1

THE CONSTRUCTION INDUSTRY - ANSWERS

Statistics in the construction sector allow changes and trends to be analysed. They give a perspective of trends in the construction industry in Northern Ireland and allow some international comparisons. It also helps to determine initiatives that may influence the future.

Statistics can be used by insurance companies to set premiums.

For businesses, statistics allow them to forward plan by looking at current trends.

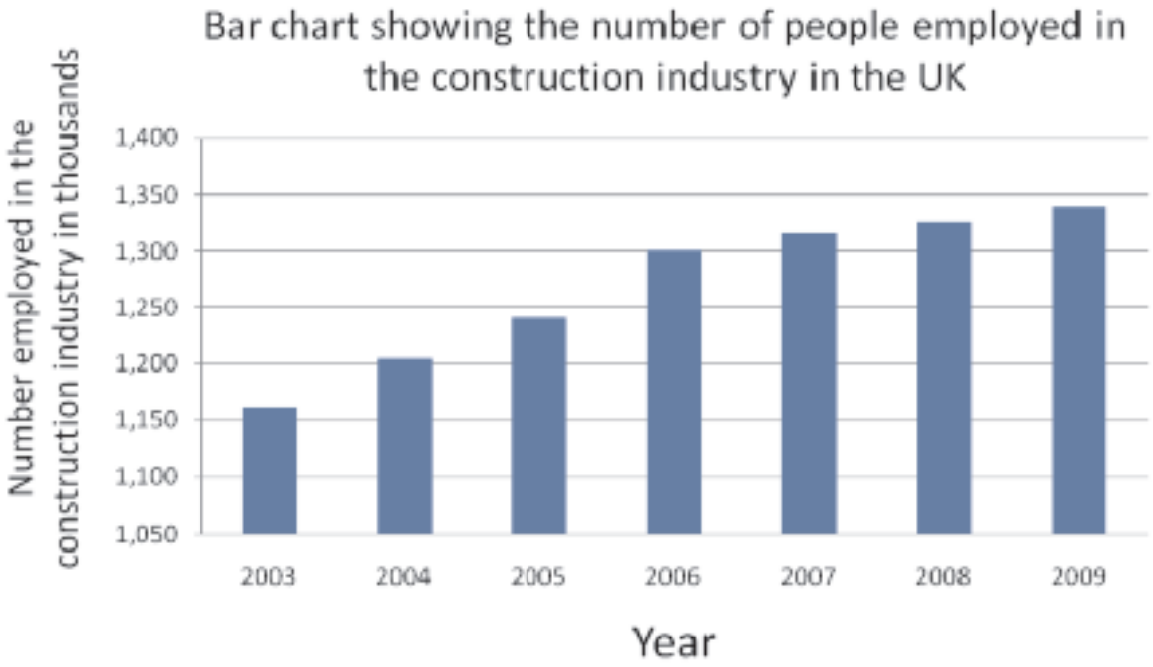
BAR CHARTS

Remember that bar charts are one way of displaying information.

When you draw a bar chart, you need to decide what it is you want your chart to illustrate. Then you need to consider

1. What will the title be?
2. How many bars will you need?
3. What scale will you need for the other axis?
4. Draw and label the two axes.
5. Draw the bars.

Look at the bar chart below taken from http://www.statistics.gov.uk



HANDLING DATA ANSWERS - TASK 1

THE CONSTRUCTION INDUSTRY - ANSWERS

Section 1

Look at the information in the chart on the construction industry from the source material. Decide whether these statements are true or false.

1. The bar chart shows how many people were employed in the construction industry in Northern Ireland from 2003 to 2009.

True / (False)

2. One thousand three hundred people were employed in the construction industry in 2006.

True / (False)

3. The biggest increase in the number of people employed in the construction industry was seen between 2005 and 2006.

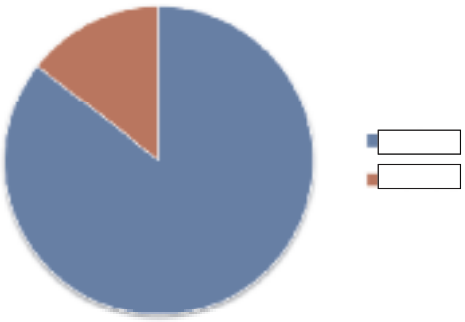
(True) / False

HANDLING DATA ANSWERS - TASK 1

PIE CHARTS

Pie charts are useful to compare different parts of a whole amount. Pie charts are circles divided into segments, where each segment represents a fraction of the total amount.

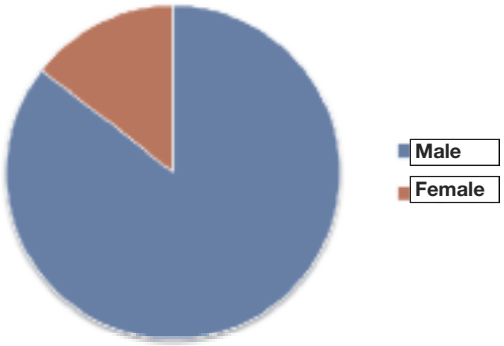
The pie chart below shows the proportion of males and females employed in the construction sector in the UK in 2009.



Section 2

Look at the information in the pie chart.

1. What labels should go on the right hand side? Write your answer on the chart.



Decide whether these statements are true or false.

2. There are more males than females employed in the construction sector in 2009.

True / False

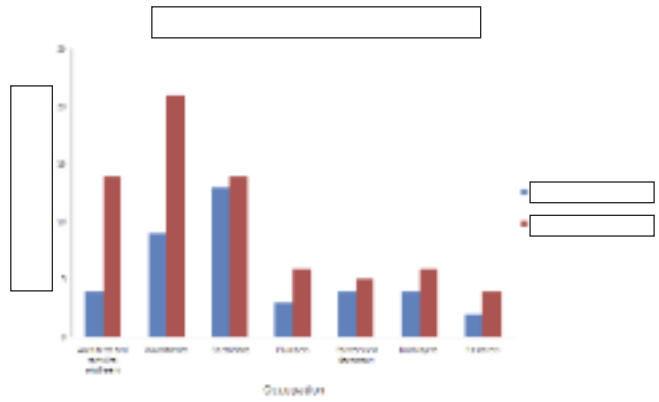
3. About one quarter of the total people employed in the construction industry is female.

True / False

HANDLING DATA ANSWERS - TASK 1

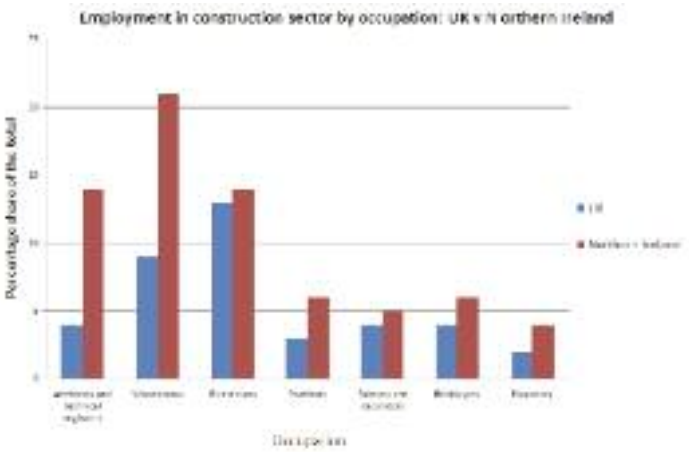
COMPARISON BAR CHART

The **Comparison bar chart** is used when we want to represent two sets of data on the same chart. We can put the bars side by side or we may put the bars of one set of data on top of the bars of the other set of data.



Section 3

When the comparison bar chart was drawn the labels were missing. They are below. Can you write in where they should be on the chart?



Number employed in the construction industry in the UK in thousands

Males

Females

Year

Chart showing the numbers of males and females employed in the construction industry.

Did your chart look like this?

Look at the information in the comparison bar chart. Decide whether these statements are true or false.

1. The percentage of people employed in the construction sector as plumbers is greater in the UK than in Northern Ireland.

True / (False)

2. The percentage of people employed in the construction sector as architects / technical engineers is greater in Northern Ireland than in the UK.

(True) / False

3. The percentage of people employed in the construction sector as electricians is approximately the same in both regions.

(True) / False

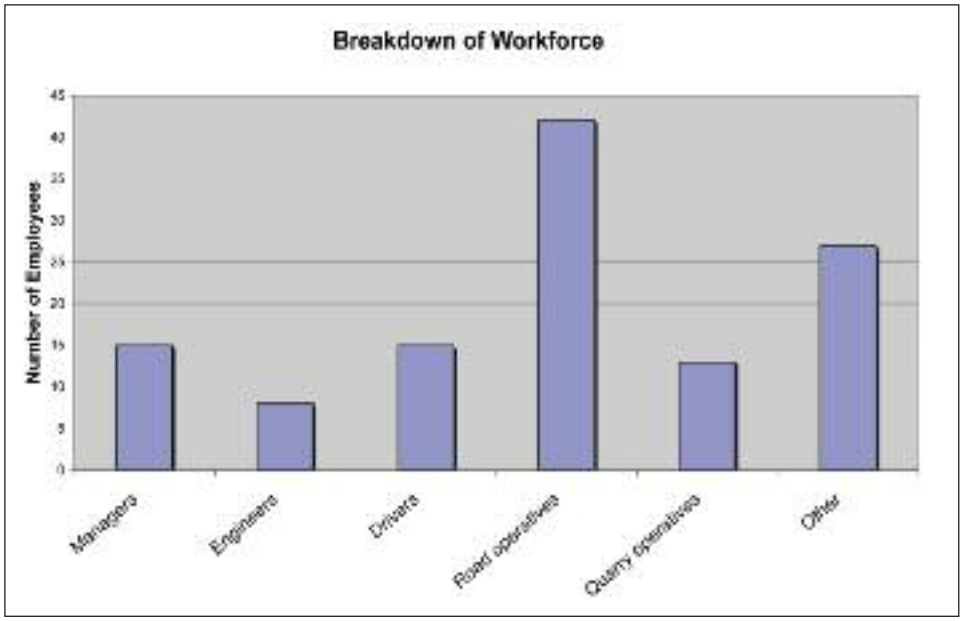
HANDLING DATA ANSWERS - TASK 2

THE WORKFORCE - ANSWERS

It is important for a company to monitor the makeup of their workforce both those directly employed by the company and also any subcontracted staff. This allows them to identify areas where there may be a high turnover of staff or where it has been difficult to get suitable qualified employees. Where there is a skill shortage companies need to forward plan. This may mean diversifying the skills of current employees to meet the shortage in the longer term.

Managers	15
Engineers	8
Drivers	15
Road Operatives	42
Quarry Operatives	13
Other	27

1. Display this information on a Bar chart.



HANDLING DATA ANSWERS - TASK 2

The average is a typical value. In the next section when we talk about average we are talking about mean. There are other types of average but we want to look at mean. It is easy to calculate: Just add up all the numbers, then divide by how many numbers there are.

$$Mean = \frac{Total}{Number\ of\ values}$$

The engineers worked the following hours last month:

181	203	217	184
179	221	233	165
194	0		

2. What is the mean number of hours worked last month by the engineers?

Total hours worked by all 10 engineers =

181 + 203 + 217 + 184 + 179 + 221 + 233 + 165 + 194 + 0 = 1777 hrs

Mean number of hours worked = Total hours worked ÷ number of engineers

177 ÷ 10 = 177.7 hrs (178 hrs)

3. What is the range of hours worked last month by the engineers?

233 - 0 = 233 hrs

HANDLING DATA ANSWERS - TASK 2

4. A new engineer joined the company this month and she worked 204 hours. What is the mean number of hours worked this month by the engineers if the others worked the same number of hours as in the previous month?

Total hours worked by all 11 engineers =

1777+204 = 1981

Mean number of hours worked = Total hours worked ÷ number of engineers =

1981 ÷ 11 = 180.0909091 (calculator display)

5. What is this figure rounded to the nearest hour?

180 hrs

6. How has the arrival of the new employee affected the mean number of hours worked?

It has increased

7. How has the range of hours worked been affected?

unaffected

HANDLING DATA ANSWERS - TASK 3

AVERAGE AND RANGE - ANSWERS

Averages look at what we mean when we think of the "typical" value in a collection of data. The concept is extremely important and we encounter it frequently in construction, because we regularly work with numerical quantities. For example, the average number of bricks needed for a wall with particular dimensions or before accepting a job, you might want to know what a typical salary is for someone in that position. The concept of "typical" or "average" is an important one in the construction sector.

Mean

The ***average*** is a typical value. In this section when we talk about average we are talking about ***mean***. There are other types of average but we want to look at mean.

It is easy to calculate: Just ***add up*** all the numbers, then ***divide by how many*** numbers there are.

$$\text{Mean} = \frac{\text{Total}}{\text{Number of values}}$$

Example

The lengths of off cuts of wood in a workshop are:

400mm 200mm 150mm 330mm

To find the average (mean) length of wood we:

Total = 400 + 200 + 150 + 330 = 1080mm

Number of values = 4

$$\text{Mean} = \frac{1080}{4} = 270\text{mm length}$$

Check your answer is correct by doing the reverse calculation. 270 × 4 = 1080

1. Four site operatives earn £6.50 an hour and the site foreman earns £15 an hour. What is the mean wage?

£6.50 + £6.50 + £6.50 + £6.50 + £15 = £41

£41 ÷ 5 = £ 8.20

HANDLING DATA ANSWERS - TASK 3

2. Does this wage represent the salaries that those on the site earn i.e. is it a typical value?

£8.20 is more than the rate most of the employees on site earn

3. The ages of site operatives on a particular building site are:

23 35 28 35 41 21 20

What is the average (mean) age?

$$\text{Mean} = \frac{\text{total}}{\text{number of items}}$$

Total = 23+ 35 + 28 + 35 + 41 + 21 + 20 = 203

Mean = 203 / 7 = 29 years of age

4. Employees at a builder's yard are paid the hourly wages listed below. What is the mean hourly wages?

£5.15, £8.95, £5.75, £5.50, £5.25, £5.40.

£5.15 + £8.95 + £5.75 + £5.50 + £5.25 + £5.40 = £36

£36 ÷ 6 = £6

HANDLING DATA ANSWERS - TASK 3

Range

The range is the difference between the highest and lowest values in a set of numbers. It tells you how spread out the values are.

To find it, **subtract the lowest number in the set of numbers from the highest**.

Range = highest value – lowest value

Example

The ages of students on a joinery course are shown below. What is the range in ages?

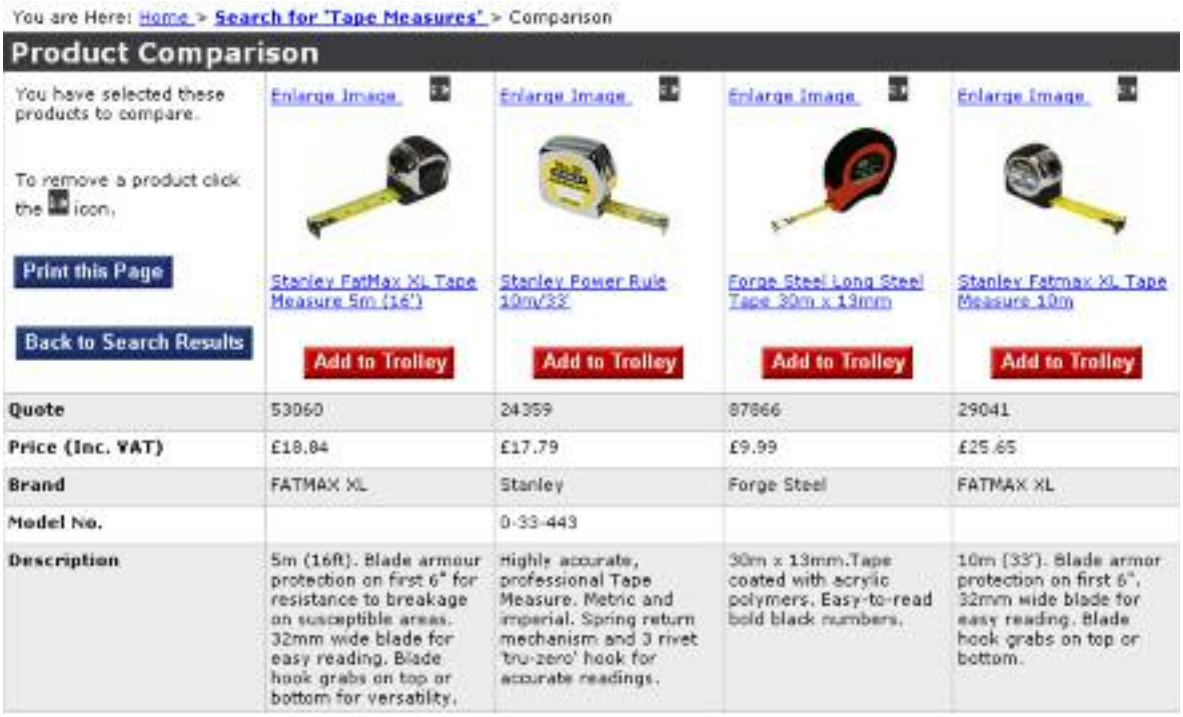
16 17 19 17 18 16 30

Range = highest value – lowest value

Range = 30 – 16 = **14 years**

HANDLING DATA ANSWERS - TASK 3

5. The prices for a tape measure are shown below. Find the price range?



You are Here: Home > Search for 'Tape Measures' > Comparison

Product Comparison

You have selected these products to compare.

To remove a product click the icon.

Print this Page

Back to Search Results

	Enlarge Image	Enlarge Image	Enlarge Image	Enlarge Image
	Stanley FatMax XL Tape Measure 5m (16')	Stanley Power Rule 10m/33'	Forge Steel Long Steel Tape 30m x 13mm	Stanley Fatmax XL Tape Measure 10m
	Add to Trolley	Add to Trolley	Add to Trolley	Add to Trolley
Quote	53060	24359	87866	29041
Price (Inc. VAT)	£18.84	£17.79	£9.99	£25.65
Brand	FATMAX XL	Stanley	Forge Steel	FATMAX XL
Model No.		0-33-443		
Description	5m (16ft). Blade armour protection on first 6" for resistance to breakage on susceptible areas. 32mm wide blade for easy reading. Blade hook grabs on top or bottom for versatility.	Highly accurate, professional Tape Measure. Metric and imperial. Spring return mechanism and 3 rivet 'tru-zero' hook for accurate readings.	30m x 13mm.Tape coated with acrylic polymers. Easy-to-read bold black numbers.	10m (33'). Blade armor protection on first 6". 32mm wide blade for easy reading. Blade hook grabs on top or bottom.

£25.65 - £9.99 = £15.66

HANDLING DATA ANSWERS - TASK 3

6. Employees at a builder's yard are paid the hourly wages listed below. What is the range of these hourly wages?

£7.50, £9.25, £8.75, £9.50, £7.25, £8.50.

£ 9.50 - £7.25 = £2.25

7. The hours worked on site for 5 employees are shown below. What is the range of hours worked and what is the mean number of hours worked.

36 32 40 39 38

36 + 32 + 40 + 39 + 38 = 185

185 ÷ 5 = 37 hours

Range = 40 -32 = 8 hours

HANDLING DATA ANSWERS - TASK 3

A building contractor employs 10 construction tradespersons on a full-time basis. All skilled construction trade employees are paid the same basic annual salary of £25,250. As managing director he pays himself an annual salary of £99,500. He is looking to take on another full-time bricklayer and advertises in the jobs section of a trade publication. The advertisement claims that the average salary in the company is £32, 000.

8. Is this claim correct?

Total salary bill for company for 10 tradespersons and the managing director

10 x 25,250 = 252,500

99,500 + 252,500 = £352,000

Mean salary = Total salary ÷ 11 =

£352,000 ÷ 11 = £32,000

The claim is correct.

9. Is this advertisement fair? If not why not?

No it is not fair. The large director's salary enhances the mean. The advert should not have used to directors salary in a calculation of the mean salary for the tradespersons.

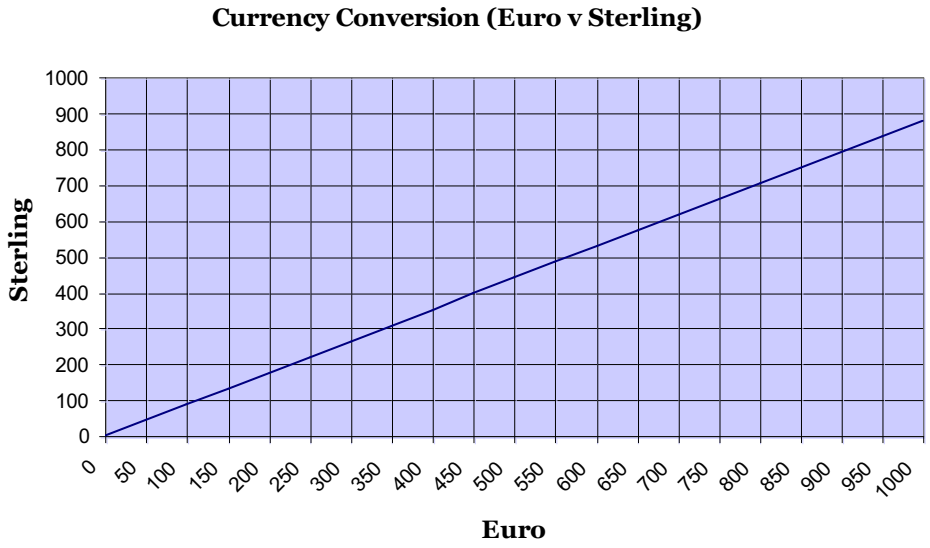
HANDLING DATA ANSWERS - TASK 4

BUILDING TRADE - ANSWERS

The following table shows the volume of sales revenue (£000's) last year for five building supplies businesses chosen at random in Northern Ireland, Republic of Ireland and England.

Northern Ireland (£)	Republic of Ireland (€)	England (£)
356	179	215
413	568	6305
167	800	451
48	348	87
192	266	0
Total 1176	Total £2161 €2455	Total 7058

1. Use the conversion graph below to convert the figure for Republic of Ireland from € to £ so a comparison can be made.



2. Did you convert each value individually or did you use an alternative method?

Note: on account of the scale of graph answers are necessarily approximate as estimation is required.

Alternative method is to first total Euro in table to get €2455.

Approximate this as €2400 because 2400 = 3 x 800 and €800 to £700 is a very straightforward conversion on the graph as it lies on a grid point.

Then by direct proportion 3 x 700 = £2100. This compares quite well with the 'exact' amount of £2161

HANDLING DATA ANSWERS - TASK 4

3. Now complete the table above so the totals are in £.

4. Calculate the mean revenue for building supplies businesses in the separate regions.

Northern Ireland

Total revenue = 1176

Mean = Total revenue ÷ 5 = 1176 ÷ 5 = 235.2

What does the displayed by your calculator mean in terms of money?

It means 235.2 thousands of pounds. This is £235,200

Republic of Ireland

Total revenue = 2161

Mean = Total revenue ÷ 5 = 2161÷ 5 = 432.2

What does the displayed by your calculator mean in terms of money?

£432,200

England

Total revenue = 7058

Mean = Total revenue ÷ ? = 7058÷ 5 = 1411.6

What does the displayed by your calculator mean in terms of money?

£1,411,600

HANDLING DATA ANSWERS - TASK 4

5. Determine an all-Ireland national average (mean) and compare it to the figure you already have for England.

All-Ireland

Total revenue = 1176 + 2161 = 3337

Mean = Total revenue ÷ ? = 3337÷ 10 = 333.7

Compare:

All-Ireland	£333,700
England	£1,411,600, approximately 4 times as large

6. Which region had the largest range in revenues last year according to the data in the table above?

If you are able to answer this without having to do any calculations please explain why:

England, quite easy to see as England had one company whose revenue was much larger than any other company in the table (£6,305,000) and another company whose revenue was £0.

HANDLING DATA ANSWERS - TASK 5

CONSTRUCTION MACHINERY

On site you will encounter a wide range of plant machinery from dozers to excavators to loaders and lorries. Each has a specific function on site and that function will determine the design and specification of the vehicle. Below are cards showing a range of plant machinery and their dimensions. Compare the vehicles and look at the weight, lengths and power of each.

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Engine power- 259 kW
Max. Operating Weight - 38,488 kg
Overall length - 5.6m
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SKID STEER LOADERS

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Engine power – 205kW
Max. Operating Weight – 29,000kg
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HANDLING DATA ANSWERS - TASK 5

DUMP TRUCK

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Engine power – 246 kW
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BACKHOE LOADER

J

Engine power – 74.2kW
Max. Operating Weight – 8,660kg
Overall length - 5.9 m
Fuel tank – 160 litres

HANDLING DATA ANSWERS - TASK 5

Using the cards for construction machinery, answer the questions below.

1. What is the range of engine powers in the vehicles?

259 - 52 = 207kw

2. Round each of the lengths to the nearest metre.

VEHICLE	LENGTH ROUNDED to nearest metre	VEHICLE	LENGTH ROUNDED to nearest metre
A. Bulldozer	6m	F. Mobile Crane	11m
B. Tracked Excavator	8m	G. Dump Truck	7m
C. Skid steer Loaders	3m	H. Vibrating Roller	5m
D. Medium Dozer	5m	I. Roller	5m
E. Wheeled Loader	8m	J. Backhoe Loader	6m

3. For the two dozers (A) and (D), what is the average (mean) engine power?

259 + 93 = 352

352 ÷ 2 = 176 kw

4. What is the range in lengths of the construction vehicles?

53,140 – 2650 = 50,490kg

HANDLING DATA ANSWERS - TASK 5

5. Work out the order of the cards based on the actual overall length of each vehicle. You don't need to write out the name of each vehicle, simply use the letters on each card A to J.

Vehicles - smallest to largest overall lengths	
1	C
2	H
3	D
4	I
5	A
6	J
7	G
8	E
9	B
10	F

6. What is the range in lengths of the construction vehicles?

10.5 – 3.27 = 7.23m

7. What is the range in sizes of the fuel tanks?

643 – 80 = 563 litres

8. What is the operating weight of the mobile crane in tonnes?

29,000 ÷ 1000 = 29 tonnes

HANDLING DATA ANSWERS - TASK 6

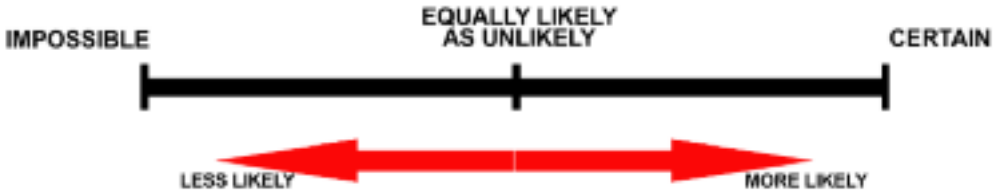
CHANCES ARE - ANSWERS

Probability is an area of mathematics used to measure uncertainty. In life the outcome of many events is not predictable but it is possible to get an idea of how likely some things are to happen. Being able to tell how likely something is to happen is very important in construction especially when it comes to health and safety. Insurance companies base their premiums directly on probabilities.

A scale is used to represent probability with “impossible” at one end and “certain” at the other. All other outcomes can be placed somewhere on the scale between these two extremes. Things that are unlikely are placed near the impossible end whilst things likely to happen are placed near the certain end. We can use common sense to place some outcomes on the scale….

1. For example, place the following outcomes on the probability scale below

A. Someone chosen at random from a construction trade is a man
B. Someone who follows all safety guidelines has an accident
C. A mortar mixture will harden if someone forgot to add cement
D. A warm but poorly insulated building will lose heat on a cold day
E. Someone chosen at random from the community is a woman



A. Very likely so very near the certain end.
B. Unlikely but not impossible, quite near impossible end.
C. Impossible.
D. Certain.
E. Equally likely as unlikely so in the middle of the scale.

HANDLING DATA ANSWERS - TASK 6

Sometimes we cannot just tell from common sense how likely an outcome is or whether one outcome is more likely than another. In order to tell if some outcomes are more likely than others we need to represent probabilities using fractions. The top of the fraction is the number of favourable outcomes and the bottom of the fraction is the number of possible outcomes.

$$\textbf{Probability} = \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}}$$

2. Complete the following table to help you practice working with different kinds of fractions and then you can try to answer some probability questions.

Fraction	Decimal	Percentage	Outcome description
0	**0**	**0**	Impossible
1/10	0.1	10	**Very unlikely**
1/4	**0.25**	25	Unlikely
1/2	**0.5**	**50**	Just as likely as not to happen
3/4	0.75	**75**	**Likely**
9/10	**0.9**	90	Very likely
1	**1**	**100**	**Certain**

Use the definition of probability given above to determine how probable the following events are to happen.

3. McAteer and Bushe, a local construction company, have purchased 4 brand new lorries. Only one of them has air-conditioning for the cab. If a driver chooses a lorry to drive at random what is the probability it will have air-conditioning.

1/4

4. What is the probability it won't have air-conditioning?

3/4

HANDLING DATA ANSWERS - TASK 6

5. If you have not already done so express your answers to the latter two questions in percentage form.

25% and 75%

6. What do you notice about the answers when you add them together?

They add to 100%

7. The probability of a lorry breaking down in service is 0.05. Use what you have learned in the previous question to determine the probability that a lorry will not break down in service.

0.1= 10%

10% + 90% = 100%

So required probability is 90%

8. Write down a rule to help you find the probability of something not happening if you already know the probability of it happening.

Probability of happening + probability of not happening = 100%

HANDLING DATA ANSWERS - TASK 7

HEALTH AND SAFETY

As mentioned in the previous task, one important use of probability in the construction sector is linked to the management of health and safety. You can now try to apply what you have learned above to the following scenario:

A Safety at Work study has been carried out for the construction industry in another EU country. It has been determined there is a 1% chance an operative (18-65 years old) will have an accident whilst driving machinery.

1. What is the probability that an operative will not have an accident whilst driving machinery?

100 – 1 = 99%

or

1-0.01 = 0.99

2. If 1% of the 30000 operatives working in Northern Ireland have an accident when using machinery, how many would that be?

30000 ÷ 100 = 300

HANDLING DATA ANSWERS - TASK 7

The study also looked at safety of pneumatic drills and found that there is a 1 in 50 (that's 2%) chance an operative will have an accident whilst using one.

3. Which of the activities appears to be more accident prone, driving machinery or using a pneumatic drill?

2% is more than 1% so

Pneumatic drill is more accident prone

Of the 30000 operatives referred to above, 1500 of them are over 50 years old.

4. What is the probability that an operative is over 50?

1500/30000 = 15/300 = 1/20 (because 20 x 15 = 300)

or 15/300 = 5/100 = 1/20
or 15/300 = 3/60 = 1/20

There are ten different tasks given to operatives in one company. Five involve driving machines, two involve using pneumatic drills and three involve the use of hand tools.

5. What is the probability an operative will be given a task involving a hand tool?

3/10

HANDLING DATA ANSWERS - TASK 7

6. What is the probability that the operative will NOT be given a task involving a hand tool?

7/10

7. What is the probability that the operative will be given a task involving use of a pneumatic drill?

2/10 = 1/5

Useful Websites





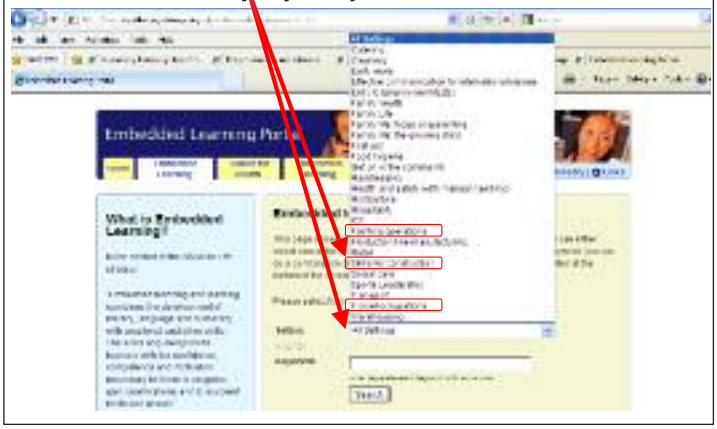
There are many useful websites you can sue to practice your skills:

http://rwp.excellencegateway.org.uk/embeddedlearning/index.cfm

This site contains Skills for Life Materials for Embedded Learning aiming to help you improve the literacy or numeracy skills you need for work. There are some interactive materials set in everyday contexts and giving practice in some of the literacy and numeracy skills developed in the paper-based materials.

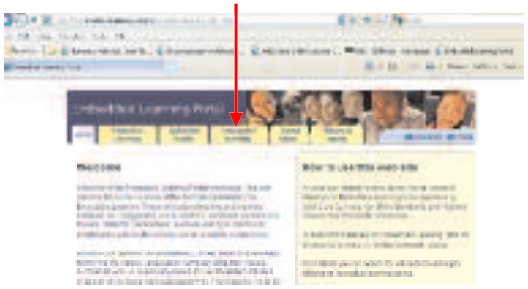
To find the resources for your trade click on the EMBEDDED LEARNING tab

Select from the drop down menu beside SETTING, your trade area. Click the Enter/ Return key on your keyboard.

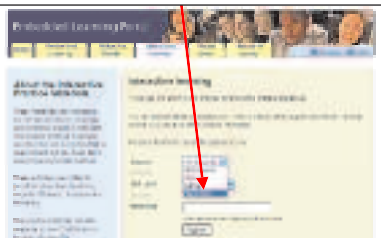


The literacy and numeracy resources available for that trade area will appear.

To access interactive resources click on the INTERCATIVE LEARNING tab.

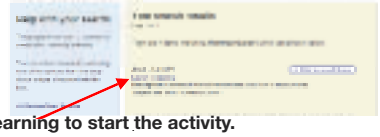


Choose numeracy from the drop down menu beside SUBJECT.



Beside skill level choose level 1

Then enter the word for the topic you want to learn more about – for example: AREA. Then click on search.



Click on launch e-learning to start the activity.

http://www.bbc.co.uk/skillswise/
This website has factsheets, worksheets and interactive quizzes to help you practice your numeracy skills.

http://www.keyskills4u.com/index.asp
This site includes 'Key Skills trainer', to help you develop your numeracy skills.