Essential Skills

National 5 Applications of Mathematics

Content:

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2	Equivalent Fractions , Decimal & Percentages	2	Container Packing	2	National Insurance
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5	Probability (Simple and Complex)	5	Pythagoras' Theorem	5	Credit Agreements
6	Expected Frequency	6	Gradient	6	Profit and Loss
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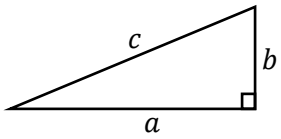
10	Reading Scales	10	Scale Drawing		

FORMULAE LIST

Circumference of a circle $C = \pi d$

Area of a circle $A = \pi r^2$

Theorem of Pythagoras



$a^2 + b^2 = c^2$

Volume of a cylinder $V = \pi r^2 h$

Volume of a prism $V = Ah$

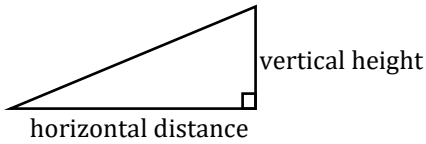
Volume of a cone $V = \frac{1}{3}\pi r^2 h$

Volume of a sphere $V = \frac{4}{3}\pi r^3$

Standard deviation $s = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$

or $s = \sqrt{\frac{\sum x^2 - (\sum x)^2/n}{n-1}}$, where *n* is the sample size.

Gradient



$$\text{gradient} = \frac{\text{vertical height}}{\text{horizontal distance}}$$

The skills in this series of exercises appear frequently.

These are the GIFTS you must take to succeed.

Numeracy Unit

Exercise 1

Add and Subtract Fractions **(Non-Calculator)**

Simplify:

1. $\frac{3}{7}+\frac{2}{5}$

2. $\frac{2}{3}+\frac{1}{2}$

3. $\frac{3}{4}-\frac{2}{3}$

4. $3-\frac{8}{9}$

5. $\frac{1}{4}+\frac{2}{3}+\frac{4}{5}$

6. $\frac{5}{8}+\frac{1}{5}+\frac{2}{7}$

7. $1-\left(\frac{1}{4}+\frac{3}{7}\right)$

8. $2-\left(\frac{6}{7}+\frac{1}{3}\right)$

9. $4-\left(\frac{5}{6}+\frac{3}{4}\right)$

10. $2-\left(\frac{1}{2}+\frac{2}{3}+\frac{1}{9}\right)$

Applying Question

A warren of rabbits are brindled, mottled and white.

$\frac{1}{5}$ of the rabbits are brindled.

$\frac{3}{7}$ of the rabbits are white.

The remaining rabbits are mottled.

Calculate the fraction of rabbits that are mottled.

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Numeracy Unit

Exercise 2

Comparing Fractions, Decimals and Percentages **(Non-Calculator)**

Write each as a percentage, decimal fraction and fraction. Round to 2 decimal places if required.

1. 22%

2. 0·08

3. $\frac{3}{20}$

4. 55%

5. 0·7

6. $\frac{32}{40}$

7. 12·5%

8. 0·675

9. $\frac{5}{8}$

10. $\frac{6}{7}$

Applying Questions

1. Write the following values in order from greatest to least.

$$0{\cdot}832,\ \frac{5}{6},\ 83{\cdot}38\%,\ 0.83$$

Justify your answer.

2. Alex plays hockey for Clydesdale Hockey Club in Glasgow.

In the 2022 season he scored 25 goals in 40 appearances.

In the 2023 season he scored 18 goals in 32 appearances.

He claims this is an improvement. Is this an accurate claim?

Justify your answer.

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Numeracy Unit

Exercise 3

Express a Quantity as a Percentage **(Calculator)**

Express each increase or decrease as a percentage of the original quantity.

1. £50 increased to £68
2. 300 ml decreased to 219 ml
3. 65 kg decreased to 57 kg
4. 15 cm increased to 18·4 cm
5. £18000 increased to £19600
6. 3 litres decreased to 1640 ml
7. 5000 metres increased to 6.04 km
8. 154 cm increased to 1.74 metres
9. 8 kg decreased to 3758 grams
10. 500 mm decreased to 29 cm

Applying Questions

1. Callum sells an unwanted pair of shoes on Vinted.

   He paid £95 for them and is selling them for £40.

   Express this loss as a percentage of the original purchase price.

2. A school roll for session 2023/24 was 584 pupils.

   In session 2024/25 it was 619 pupils.

   Express this growth as a percentage.

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Numeracy Unit

Exercise 4

Appreciation and Depreciation (Calculator)

Calculate:

1. £400 appreciating at 2.8% p.a. for 3 years.
2. £3500 depreciating by 13.4% p.a. for 4 years.
3. 15km increasing by 8% per week for 6 weeks.
4. 384 litres decreasing at 7.5% per month for 3 months.
5. £5040 increasing by 5.6% per year for 4 years.
6. 400mg depreciating by 24% per hour for 3 hours.
7. 720ml decreasing by 9.2% per hour for 4 hours.
8. £260,500 appreciating by 3.7% p.a. for 5 years.
9. 550 pupils on a school roll increasing by 3% per year for 4 years.
10. £499 depreciating by 4.6% per year for 3 years.

Applying Questions

1. The iPhone 16 released in September 2024, costing £799.

   It will depreciate by 4% in its first month after unboxing and 6% each month afterwards.

   Calculate the value of the iPhone after 3 months.

   Give your answer to 3 significant figures.

2. A classic car is valued at £37000 in 2024.

   It is estimated to depreciate by 2.7% in the first year after purchase and appreciate by 4.5% each year thereafter.

   Calculate the estimated value of the car in 2028.

   Give your answer to 2 significant figures.

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Numeracy Unit

Exercise 5

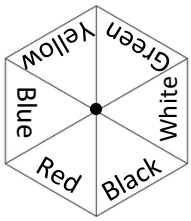
Probability (Non-Calculator)

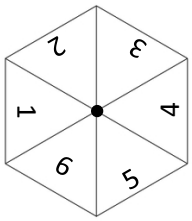
Calculate the probability of:

1. Picking a red Queen from a standard deck of cards.
2. Rolling lower than 3 on a standard 6-sided dice.
3. A spinner numbered 1 – 12, landing on a prime number.
4. A roulette wheel with 37 numbers landing on a square number.
5. Two 6-sided dice landing on a total greater than 7.
6. Two 9-sided dice landing on a total less than 10.
7. Two 8-sided dice landing on a total greater than 9.
8. Two 5 sided spinners one labelled A-E, the other 1-5, landing on an odd & vowel.
9. Two 5 sided spinners one labelled A-E, the other 1-5, landing on an even & consonant.
10. Two 5 sided spinners one labelled A-E, the other 1-5, landing on an A or B & 4 or less.

Applying Questions

1. 2 six-sided spinners are shown.





Calculate the probability of landing on a green or white and an odd number.

2. A prize tombola has 100 tickets numbered 1 – 100.

   To win a prize the digit sum must total 9 or more.

   There is also a dice game with two standard dice.

   To win a prize you must roll a combined total of 7 or more.

   Which game provides the greater chance of winning a prize?

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Numeracy Unit

Exercise 6

Expected Frequency **(Calculator)**

Calculate the following:

1. The probability a team wins a match is 0.32. How many are wins are expected from 20 matches?
2. The probability an office worker will catch a bug is 0.04. How many in an office of 60 employees are expected to catch the bug?
3. The probability of snow on a December day in Airdrie is 0.27. How many days of snow are expected?
4. The probability of a Ryanair flight arriving on time is 0.34. How many of their 38 flights into Edinburgh airport are expected to arrive on time?
5. The probability of a pupil wearing a tie is 0.86. How many of 560 are expected to be wearing a tie?
6. The probability of a damaged egg in a batch is 0.08. How many of 30 dozen are expected to be damaged?
7. The probability a salesman signs up a customer outside Tesco is 0.012. How many customers would they be expected to sign up from 600 customers?
8. The probability that a pupil in Brannock High will have full attendance is 3.2%. How many from 586 pupils are expected to have full attendance?
9. 24 of 42 National 5 pupils achieved an A grade last session. How many of 50 pupils are expected to get an A grade this year?
10. The probability of a parcel going missing in transit is 0.054. How many of 140 parcels are expected to be lost in transit?

Applying Question

A broadband provider claims it will only drop below 30mbps download speed 0.0138 days in a year.

In 2023 there were 6 days where it dropped below 30mbps.

Determine if this is more or less than expected.

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Numeracy Unit

Exercise 7

Direct Proportion (Calculator)

Calculate:

1. 3 cappuccinos cost £10.20. How much will 4 cappuccinos cost?
2. A proofreader checks 265 words in 5 minutes. How many can they check in 13 minutes?
3. A runner maintaining constant speed, runs 5km in 22 minutes. How long should 8km take?
4. 7 kg of garden bark cost £19.95. How much will 20 kg cost?
5. 8 litres of paint covers 72 square metres of wall. How much will 2.5 litres cover?

6 500ml of milk costs £0.85. Is a 2 litre bottle priced proportionally at £3.50?

7. A cyclist covers 27km in 90 minutes. How far could they go in 2 hours if they maintain pace?
8. 300 grams of diced beef costs £4.62. How much will 1 kilogram cost?
9. 340 grams of pasta is 425 calories. How many grams should someone wanting 600 calories eat?
10. Asda has 2 kg of cornflakes priced at £7.20. Morrisons 750g for £2.55. Where is the best value?

Applying Question

Employees are given a bonus in proportion with their year of service to a company.

Jonathan	12 years
Graham	9 years
Susanne	5 years
Heather	13 years

Susanne is awarded £1485.

How much will the company pay out in total?

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Numeracy Unit

Exercise 8

Inverse Proportion (Non-Calculator)

Calculate:

1. 3 workers take 8 hours to wash a building roof. How long would it take 4 workers?
2. 7 pet store guinea pigs have enough dry food for 8 days. How many days will it last if 3 are purchased?
3. 5 cleaners take 2 hours to clean a building. How long would it take 4?
4. 30 horses have enough food for 15 days. How long would it last if 5 horses were sold?
5. Rick Grimes has enough food to feed 192 residents of Alexandria for 18 days. How many days would it last if the community lost 48 people to the walkers?
6. Airdrie FC have enough Bovril to last an average crowd of 1200 people 8 games. After more defeats the crowd drops by 400. How many games will the Bovril last?
7. 3 painters take 7 hours to complete a job. How long would the job take if there were 5 painters working at the same rate?
8. It takes 5 people 24 minutes to eat a box of cinema popcorn. How many minutes would it last 3 people?
9. It takes a team of 7 gardeners 12 working days to complete a job. What is the minimum number of gardeners required to complete the job in 10 working days?
10. A fast food crew with 6 workers can make 100 burgers in 3 hours. How long would it take if 2 members of the crew were off sick?

Applying Question

An employer knows that it will take 5 tradespeople 16 days to renovate a property?

The employer decides to reduce his staffing by 20% before the start of the job.

If the renovation begins on 20th October, what date will it be completed?

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Numeracy Unit

Exercise 9

Ratio (Non-Calculator)

Complete each table:

1.

2	:	5		
16	:			
Total:				

2.

5	:	7		
	:	112		
Total:				

3.

6	:	1		
	:			
Total: 203				

4.

2	:	1	:	3		
	:		:	81		
Total:						

5.

4	:	2	:	9		
	:	30	:			
Total:						

6.

9	:	5	:	2		
54	:		:			
Total:						

7.

1	:	3	:	4		
	:		:			
Total: 184						

8.

5	:	11	:	4		
	:	132	:			
Total:						

9.

13	:	7	:	10		
	:	56	:			
Total:						

10.

8	:	7	:	5		
	:		:			
Total: 840						

Applying Question

The ratio of gold medals won by Great Britain, Italy, and Japan at the 2024 Olympic Games was 13 : 8 : 9.

Japan won 45 medals.

How many medals were won by the three countries in total?

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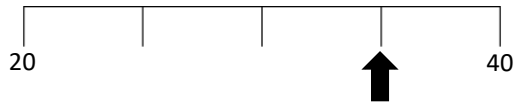
Numeracy Unit

Exercise 10

Reading Scales (Non-Calculator)

Determine the value of the pointer on each scale:

1.



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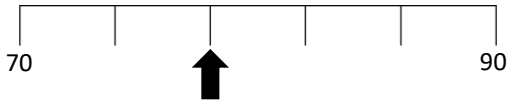

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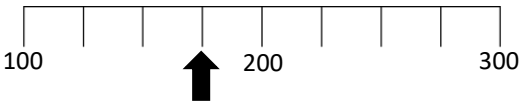
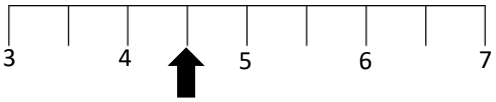


4.

5.

6.



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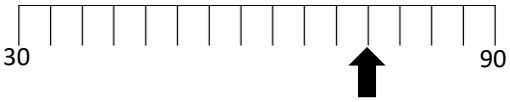

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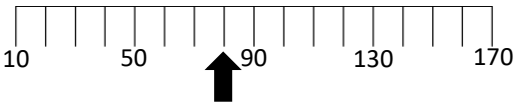
9.



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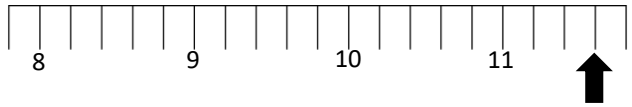


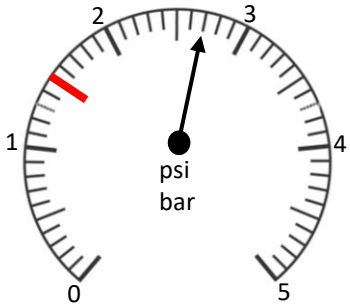
Applying Question

A combi boiler should be between 1.0 and 2.0 bar.

When refilling pressure in his boiler, John notices that he overfilled.

It is recommended only filling the boiler to 1.5 bar.

How much should John drain to make his boiler safe?



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Geometry and Measure Unit

Exercise 1

Tolerance **(Non-Calculator)**

Calculate the upper and lower limit for each:

1. 25·4 cm ± 2 mm
2. 3·6 m ± 5 cm
3. 13·1 cm ± 3 mm
4. 17·7 kg ± 1·3 kg
5. 36·8 °C ± 0·4°C
6. 673 mm ± 17 mm
7. 3·2 cm ± 10%
8. 500 g ± 5%
9. 19·6 cm ± 10%
10. 700 mm ± 3%

Applying Question

A Christmas Advent calendar has 24 doors with chocolate behind.

Galaxy will reject chocolates if they do not weigh 4·2 g ± 5%.

The weights, in grams, of 20 chocolates are shown:

4·21, 3·95, 4·15, 4·37, 4, 4·07, 4·5, 3·98, 4·25, 4·39

4·3, 3·9, 4·02, 4·43, 4·36, 4·18, 4·05, 3·99, 4·27, 4·42

Calculate the percentage of chocolates that are rejected.

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Geometry and Measure Unit

Exercise 2

Container Packing (Non-Calculator)

Find the maximum number of packages in the container:
(Packages must be aligned in the same direction.* indicates ***Must be upright***)

1.

	Length	Breadth	Height
Container	160cm	80cm	100cm
Package	12cm	9cm	24cm*

2.

	Length	Breadth	Height
Container	250cm	90cm	120cm
Package	16cm	13cm	19cm*

3.

	Length	Breadth	Height
Container	300cm	240cm	70cm
Package	35cm	21cm	32cm*

4.

	Length	Breadth	Height
Container	200cm	130cm	90cm
Package	18cm	15cm	16cm*

5.

	Length	Breadth	Height
Container	400cm	320cm	210cm
Package	45cm	30cm	40cm*

6.

	Length	Breadth	Height
Container	42cm	30cm	18cm
Package	9cm	7cm	3cm*

7.

	Length	Breadth	Height
Container	1·8m	0·75m	1·2m
Package	21cm	12cm	36cm*

8.

	Length	Breadth	Height
Container	4m	2·45m	2·5m
Package	0·6m	0·45m	0·6m*

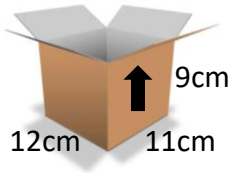
9.

	Length	Breadth	Height
Container	120cm	100cm	90cm
Package	10cm	10cm	15cm

10.

	Length	Breadth	Height
Container	150cm	110cm	70cm
Package	13cm	13cm	17cm

Applying Question



A large cardboard box is used to transport sports watches.

The watches must stay upright and aligned in the same direction.

Calculate the maximum number of watches that can be transported in a box.

The skills in this series of exercises appear frequently.

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Geometry and Measure Unit

Exercise 3

Area and Circumference of Circles **(Calculator)**

Copy and complete each:

1.

Circle			
Radius	4cm	Diameter	
Area		Circumference	

2.

Circle			
Radius		Diameter	12cm
Area		Circumference	

3.

Circle			
Radius	8.5cm	Diameter	
Area		Circumference	

4.

Circle			
Radius		Diameter	17cm
Area		Circumference	

5.

Circle			
Radius		Diameter	
Area		Circumference	28.26cm

6.

Circle			
Radius		Diameter	
Area	314cm²	Circumference	

7.

Semi-circle			
Radius	3.2cm	Diameter	
Area		Perimeter	

8.

Semi-circle			
Radius		Diameter	10.8cm
Area		Perimeter	

9.

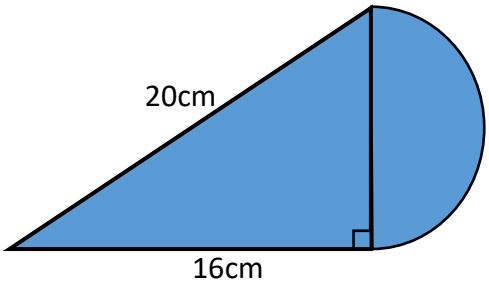
Quarter Circle			
Radius	3.7cm	Diameter	
Area		Perimeter	

10.

Quarter Circle			
Radius		Diameter	16.2cm
Area		Perimeter	

Applying Question

A design is made of a right-angled triangle and a semi-circle as shown in the diagram.



(a) Calculate the area of the design.

(b) Calculate the perimeter of the design.

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Geometry and Measure Unit

Exercise 4

Volume **(Calculator)**

Copy and complete each:

1.

Cylinder			
Radius	4cm	Diameter	
Height	7cm	Volume	

2.

Cone			
Radius	6cm	Diameter	
Height	13cm	Volume	

3.

Sphere			
Radius	3.5cm	Diameter	
Height		Volume	

4.

Cylinder			
Radius		Diameter	18.6cm
Height	5cm	Volume	

5.

Cone			
Radius		Diameter	13.4cm
Height	12cm	Volume	

6.

Sphere			
Radius		Diameter	11.2cm
Height		Volume	

7.

Cone			
Radius	6.3cm	Diameter	
Height	4.9cm	Volume	

8.

Hemisphere			
Radius	5.1cm	Diameter	
Height		Volume	

9.

Hemisphere			
Radius		Diameter	15.7cm
Height		Volume	

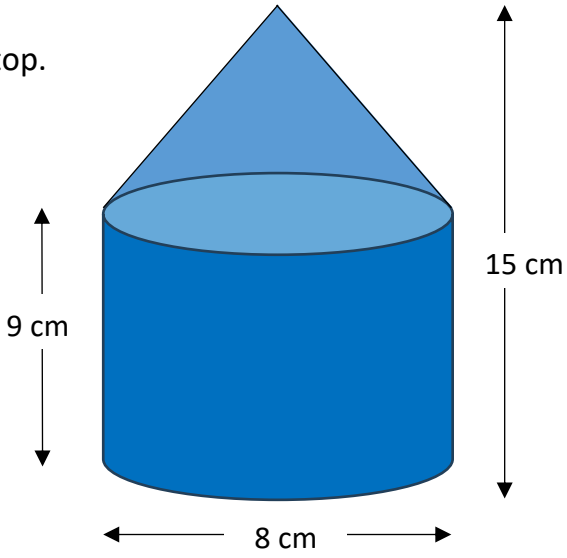
10.

Cylinder			
Radius		Diameter	7.1cm
Height	8.7cm	Volume	

Applying Question

A candle is made of a cylinder with a cone on top.

Calculate the volume.
Give your answer to 2 significant figures.



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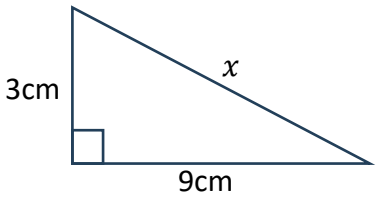
Geometry and Measure Unit

Exercise 5

Pythagoras' Theorem **(Calculator)**

Calculate the unknown side in each:

1.



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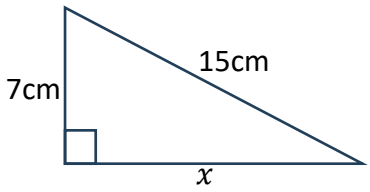

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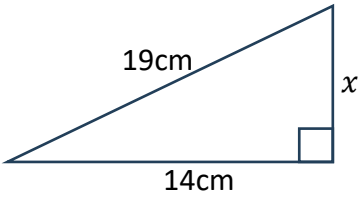

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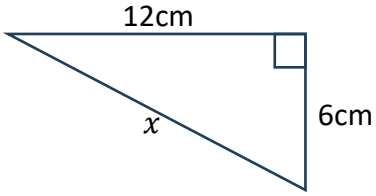
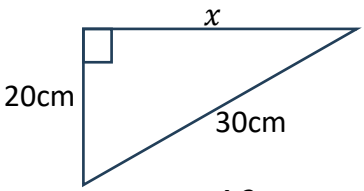


5.



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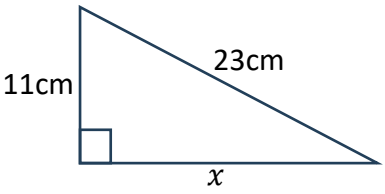

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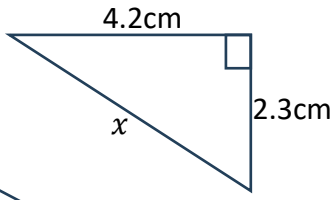

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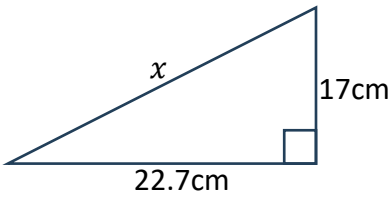

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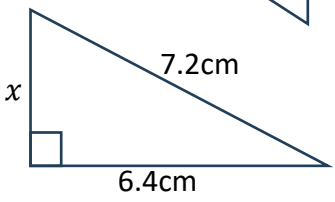

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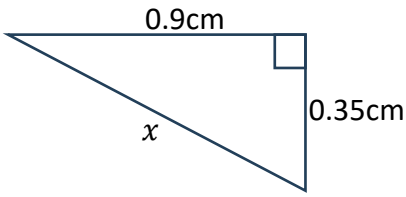


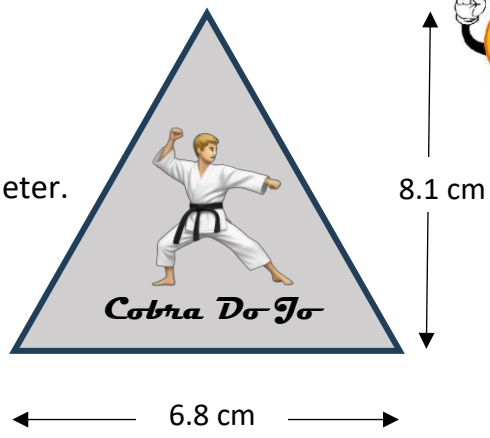
Applying Question

The badge for a karate club is shown.

It is in the shape of an isosceles triangle.

It is to be embroidered with gold ribbon around the perimeter.

How much ribbon will be needed for 30 badges?



The skills in this series of exercises appear frequently.

These are the GIFTS you must take to succeed.

Geometry and Measure Unit

Exercise 6

Gradient **(Non-Calculator)**

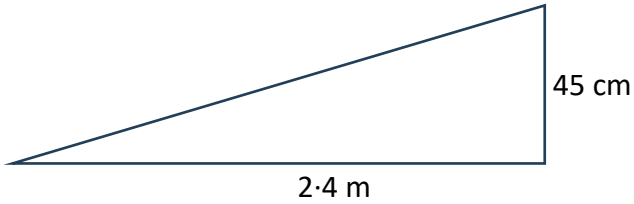
Calculate the gradient of each, writing your answer as a fraction in its simplest form:

Q	Horizontal Distance	Vertical Height
1	55 m	30 m
2	1200 mm	50 mm
3	99 cm	44 cm
4	940 cm	180 cm
5	2.4 m	740 cm
6	68 cm	140 mm
7	3 m	18 cm
8	1.2km	3880 m
9	5.6 m	820 cm
10	4.9 cm	98 mm

Applying Question

A new ramp is required for an outbuilding in the school grounds.

The height of the ramp is 45 centimetres.



To be suitable, the ramp must have a gradient of 0·17 ± 10%

Determine whether the ramp is suitable.

The skills in this series of exercises appear frequently.

These are the GIFTS you must take to succeed.

Geometry and Measure Unit

Exercise 7

Time Zones (Non-Calculator)

Berlin	GMT +1.00	**Moscow**	GMT +3.00
Sydney	GMT +11.00	**Windhoek**	GMT +2.00
New York	GMT -5.00	**Tokyo**	GMT +9.00

The time zones of 6 cities compared to UK (GMT) is shown:

1. The time in Glasgow is 0945. What time is it in Tokyo?
2. The time in Aberdeen is 2.17pm. What time is it in New York?
3. The time in Manchester is 0341. What time is it in Moscow?
4. The time in London is 11.27am. What time is it in Windhoek?
5. The time in Newcastle is 1903. What time is it in Sydney?
6. The time in Moscow is 5.55pm. What time is it in Tokyo?
7. The time in New York is 0600. What time is it in Berlin?
8. The time in Berlin is 1.25pm. What time is it in New York?
9. The time in Windhoek is 1015. What time is it in Moscow?
10. The time in Sydney is 5.13pm. What time is it in New York?

Applying Question

River is taking a 1150 flight from Edinburgh to Berlin.

The flight took off 47 minutes later than scheduled.

Berlin is 1 hour ahead of UK time.

The flight touched down at Brandenburg Airport at 1542.

How long was their flight?

The skills in this series of exercises appear frequently.

These are the GIFTS you must take to succeed.

Geometry and Measure Unit

Exercise 8

Distance, Speed and Time (Calculator)

Complete the table:

Q	Distance	Speed	Time
1	360 km	90 km/h	
2		62 mph	3 hours
3	119 metres		17 seconds
4	160 km	64 km/h	
5		420 km/h	3 hr 36 min
6	5km		24 minutes
7	256 km	48 km/h	
8		3.5 m/s	2 min 12 sec
9	585 metres		2 min 36 sec
10	284 miles	80 mph	

Applying Question

Dympna takes a flight from Edinburgh to Zimbabwe.

She departs at 1512 to fly to Frankfurt. The flight takes 1 hour 55 minutes.

There is a layover in Frankfurt.

The airplane travels at an average speed of 580 mph for the 7424-mile flight from Frankfurt to Harare, Zimbabwe.

The flight lands at 1222 local time, where it is 2 hours ahead of UK time.

How long was the layover in Frankfurt?

The skills in this series of exercises appear frequently.

These are the GIFTS you must take to succeed.

Geometry and Measure Unit

Exercise 9

Precedence Tables (Non-Calculator)

Complete the precedence table for each: (Blank tables in the appendix section)

1.

Task	Preceding Task
A	D
B	C
C	A
D	None
E	B

2.

Task	Preceding Task
A	None
B	D
C	E
D	C
E	A

3.

Task	Preceding Task
A	E
B	A,C
C	E
D	B
E	None

4.

Task	Preceding Task
A	B,C
B	D
C	D
D	None
E	A

5.

Task	Preceding Task
A	C
B	A
C	None
D	A
E	D,B

6.

Task	Preceding Task
A	None
B	D,E
C	B
D	F
E	F
F	A

7.

Task	Preceding Task
A	C,D
B	A
C	E
D	E
E	F
F	None

8.

Task	Preceding Task
A	None
B	C
C	None
D	B
E	A
F	E,D

9.

Task	Preceding Task
A	C
B	A
C	None
D	C
E	B
F	G,E
G	D

10.

Task	Preceding Task
A	None
B	E,F
C	A
D	B,C
E	A
F	A

Applying Question

The table shows the time workers need to install a new modular unit in a school.

(a) Complete the precedence diagram

(b) The council claim work should be completed within 24 hours. Is this a valid claim?

Task	Preceding Task	Detail	Time (Hours)
A	None	Begin plumbing	3
B	None	Begin cupboards	5
C	None	Begin electrics	2
D	A,B,C	Plaster walls	8
E	D	Fit wall cupboards	6
F	D	Fit floor cupboards	5
G	F	Install ICT fixtures	3
H	G	Finish electrics	3
I	E,G	Finish plumbing	4

The skills in this series of exercises appear frequently.

These are the GIFTS you must take to succeed.

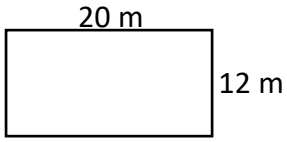
Geometry and Measure Unit

Exercise 10

Scale Drawings **(Non-Calculator)**

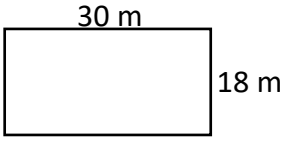
Produce an accurate scale drawing of the following:

1.



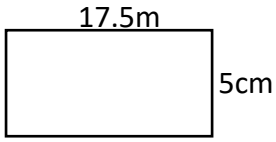
1cm = 4m

2.



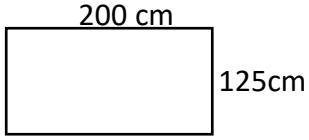
1cm = 6m

3.



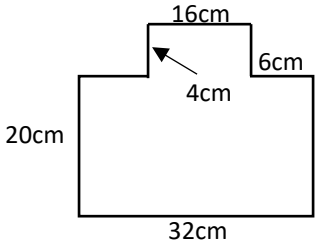
1cm = 2.5cm

4.



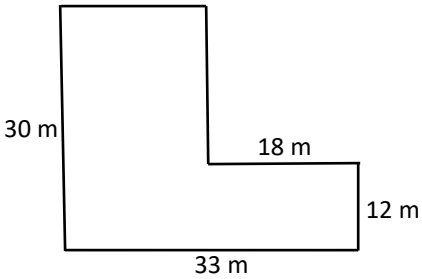
1cm = 25 cm

5.



1cm = 4cm

6.



1cm = 3m

7. Drone A is 50 km from Drone B on a bearing of 040°. Scale 1 cm = 10 km.

8. A yacht, Y, is 120 km from the harbour, H on a bearing of 125°. Scale 1cm = 20 km.

9. An airplane flies 320 km from airport A to airport B on a bearing of 233°. Scale 1cm = 40 km.

10. A jet ski drives 14 km on a bearing of 146° from shore A to B. Scale 1cm = 3 km.

Applying Question

2 ships depart from Crail harbour.

Ship A sails 55 km on a bearing of 050°.

Ship B sails 60 km on a bearing of 162°.

Scale 1cm = 10 km.

Make an accurate scale drawing of this information.

How many kilometres are the two ships now apart?

The skills in this series of exercises appear frequently.

These are the GIFTS you must take to succeed.

Finance and Statistics Unit

Exercise 1

Foreign Exchange **(Calculator)**

Euro	1.20	**Czech Koruna**	29.90
Albanian LEK	116.40	**Danish Krone**	8.85
Polish Zloty	5.05	**Swiss Franc**	1.11

The exchange rate of 6 destinations compared to £1 Sterling is shown:

1. Exchange £300 into Euros.
2. Exchange £120 into Polish Zloty.
3. Exchange £20 in Czech Koruna.
4. Exchange 9312 Albanian LEK into Sterling.
5. Exchange 97.68 Swiss Francs into Sterling.
6. Exchange 757.50 Polish Zloty into Euros.
7. Exchange 26.64 Swiss Francs into Albanian LEK.
8. Exchange 601.80 Danish Krone into Czech Koruna.
9. Exchange 87.60 Euros into Polish Zloty.
10. Exchange 208.68 Swiss Francs into Danish Krone.

Applying Question

Hope is backpacking around Europe.

She initially changes £600 into Euros.

She spends 7 days in France and Germany, spending €66 each day.

She then changes the remainder of her money into Polish Zloty to travel within Poland.

How much Zloty will she have?

The skills in this series of exercises appear frequently.

These are the GIFTS you must take to succeed.

Finance and Statistics Unit

Exercise 2

National Insurance (Calculator)

Annual National Insurance Rate	
£0 to £12584	0%
£12584 - £50284	8%
Over £50284	2%

Calculate the annual National Insurance payment of:

1. Logan earning £24600 per annum.
2. Amy earning £13800 per annum.
3. Millie earning £43200 per annum.
4. Charley earning £61540 per annum.
5. Euan earning £3200 per month.
6. Rithvik earning £4240 per month.
7. Colby earning £385 per week.
8. Ailsa earning £981 per week.
9. Declan earning £18.88 per hour, working 42 hours per week.
10. Emily-Rose earning £32.65 per hour, working 32 hours per week.

Applying Question

Weekly National Insurance Rate	
£0 to £242	0%
£242 - £967	8%
Over £967	2%

Employees pay National Insurance based on their **gross pay before** deductions.
Lachlan earns £15.80 per hour and is contracted for 36 hours per week.
Overtime is paid at time and a half.

(a) Calculate his gross pay for a week where he worked 45 hours.

(b) Calculate his National Insurance contribution for that week.

(c) His Income Tax for the week was £75.60 and his pension payment was £25.58. Calculate his net pay.

The skills in this series of exercises appear frequently.

These are the GIFTS you must take to succeed.

Finance and Statistics Unit

Exercise 3

Wages and Salaries (Calculator)

Calculate the following:

Q	Wage p/h	Basic Hours	Overtime Rate	Overtime Hours	Commission	Gross Pay	Deductions	Net Pay
1	£5.60	30				?	£11.25	?
2	£12.40	20	Double	5		?	£74.40	?
3	£8.90	16	Time & Half	2		?	£19.67	?
4	£11.50	25			5% of £400	?	£59.05	?
5	£10.20	12	Time & Half	6		?	?	£171.36
6	£17.80	37			2% of £4500	?	£191.63	?
7	?	18	Double	4		£293.80	£55.82	?
8	£13.70	35	Time & Half	?		£582.25	?	£429.88
9	£24.60	?			3% of £2000	?	£151.72	£597.08
10	£18.10	24	?	6		597.30	?	452.95

Applying Question

Paige works overtime to pay for her new car, Pedro the Polo.

Her basic rate of pay is £12.34 per hour.

She is contracted for 36 hours and is paid double time for any overtime.

Last week she worked 4 days. She worked from 0700 – 1330 took a lunch break and then worked 1430 – 2100 on each of those days.

Calculate her gross pay for the week.

The skills in this series of exercises appear frequently.

These are the GIFTS you must take to succeed.

Finance and Statistics Unit

Exercise 4

Best Buy (Calculator)

Establish the best deal for each:

1	A	B	C
TV £329	Deposit £50 8 × £40	Deposit 20% 6 × £50	Deposit 15% 7 × £47

2	A	B	C
Laptop £650	Deposit £50 6 × £110	Deposit 10% 12 × £50	Deposit £0 24 × £28

3	A	B	C
Trainers £230	Deposit £50 6 × £40	Deposit 20% 5 × £50	Deposit 15% 6 × £37

4	A	B	C
Mobile Contract	Upfront £100 24 × £25	Upfront £250 24 × £18	Upfront £0 24 × £30

5	A	B	C
4 hours Limo Hire	Upfront £50 £20 ph.	Upfront £80 £10 ph.	£35 ph.

6	A	B	C
TV Contract	Upfront £100 18 × £55	Upfront £150 24 × £39	Upfront £60 24 × £40

7	A	B	C
Gym Membership 12 Months	Free 1st month £34 pm.	£30 Per month	First 3 months FREE then £43 pm.

8	A	B	C
Spa Hotel Double Room for 1 night	Room £120 Spa £10 Breakfast £12	Room £139 Including Spa and Breakfast	Room, Spa, Breakfast £160 minus 12.5%

9	A	B	C
Caravan for 3 nights	£420 20% discount on Blue Light	£120 per night	£70 deposit £100 each night

10	A	B	C
36 Cupcakes	£2.40 per cake	£3.50 buy 2 get 1 free	£18 per pack of 6 Buy 5 packs get 1 free

Applying Question

Shaimaa needs 30 slabs for her patio:

Shop A	Shop B	Shop C
£6.20 per slab Delivery £15	£8.00 per slab Buy 2 get 1 free Delivery £40	£12.00 per slab Buy one get one free +10% for Delivery

Determine the best price for 30 slabs.
Use your working to justify your answer.

The skills in this series of exercises appear frequently.

These are the GIFTS you must take to succeed.

Finance and Statistics Unit

Exercise 5

Credit Agreements (Calculator)

Calculate the monthly instalment for each:

1. Katie-Leigh borrows £5600 for home improvements. The interest is 5.2% of the loan amount. She decided to pay back over 12 months.
2. Leon borrows £2700 for a holiday. Interest of the loan is 6.5%. He decides to pay back over 9 months.
3. Sam decided to pay his Motherwell season ticket over 10 months. The total interest was 11.6% and the cost of the ticket was £430.
4. Rebecca uses a credit agreement to purchase a car. The total cost of the credit agreement is £12700 plus 29.9%. She opts to pay over 4 years.
5. Millie buys a photocopier for her office. The cash price is £1795. The interest added is 13.1%. She pays it over 5 years.
6. 3 piece suite: Cash Price £1300. Payment Plan Price is 10% extra. 10 equal monthly payments.
7. iPhone 16: Cash Price £750. Payment Plan Price 14% extra. Deposit £150. 6 equal monthly payments.
8. Garden Furniture: Cash Price £865. Payment Plan Price £175 extra. Deposit 20%. 8 equal monthly payments.
9. Washing Machine: Cash Price £300. Payment Plan Price 18% extra. Deposit £80. 6 equal monthly payments. Final payment £94.
10. Dishwasher: Cash Price £450. Payment Plan Price 45% extra. Deposit 15% of cash price. 10 equal monthly payments. Final payment £145.

Applying Question

John Francis' Man Cave blew away during storm Eowyn.

He is quoted a new one for an advertised price of £5250.

- The payment plan is £350 more expensive than the advertised price.
- The deposit is 20% of the advertised price.
- 26 equal monthly instalments.
- Final payment £650.

Calculate the monthly instalment.

The skills in this series of exercises appear frequently.

These are the GIFTS you must take to succeed.

Finance and Statistics Unit

Exercise 6

Profit and Loss **(Calculator)**

Calculate the percentage profit or loss:

1. A mobile phone costing £480, sold for £120.
2. A football programme costing £5, sold for £9.50.
3. Running trainers costing £125, sold for £55.
4. Apartment purchased for £86000 and sold for £104920.
5. Console purchased for £500, sold for £265.
6. A coin collection purchased for £345, sold for £455.40.
7. Jacket purchased for £280, sold for £42.
8. Ingredients bought for £15.00 and home baking sold for £29.40.
9. A car bought for £26400, traded in for £9240.
10. A classic car purchased for £45000 and sold for £53550.

Applying Question

Lucy is organising a charity night to raise money for her swim team.

She hires a hall for £50, a DJ for £220 and orders a buffet that costs £18.50 per head.

She plans to invite 80 people.

Her plan is to make a profit of 60%, how much should each ticket cost?

The skills in this series of exercises appear frequently.

These are the GIFTS you must take to succeed.

Finance and Statistics Unit

Exercise 7

Pie Charts (Non-Calculator)

Calculate the angles for each sector of a pie chart:

1.

	Quantity	Angle
Sector 1	25	
Sector 2	50	
Sector 3	15	

2.

	Quantity	Angle
Sector 1	14	
Sector 2	40	
Sector 3	36	

3.

	Quantity	Angle
Sector 1	45	
Sector 2	20	
Sector 3	35	

4.

	Quantity	Angle
Sector 1	15	
Sector 2	30	
Sector 3	55	

5.

	Quantity	Angle
Sector 1	10	
Sector 2	30	
Sector 3	60	

6.

	Quantity	Angle
Sector 1	28	
Sector 2	48	
Sector 3	44	

7.

	Quantity	Angle
Sector 1	55	
Sector 2	20	
Sector 3	45	

8.

	Quantity	Angle
Sector 1	69	
Sector 2	60	
Sector 3	51	

9.

	Quantity	Angle
Sector 1	100	
Sector 2	37	
Sector 3	43	

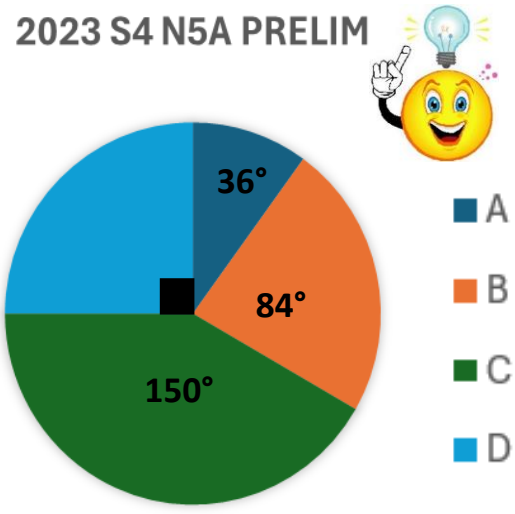
10.

	Quantity	Angle
Sector 1	84	
Sector 2	120	
Sector 3	36	

Applying Question

The pie chart shows the results from the 2023 National 5 Applications Prelim.
The table shows the numbers achieving A-D in 2024.

2024 Prelim	Quantity
A	7
B	8
C	17
D	22



The department claim that A/B grades have increased.
Is this claim accurate?
Use working to justify your answer.

The skills in this series of exercises appear frequently.

These are the GIFTS you must take to succeed.

Finance and Statistics Unit

Exercise 8

Median, Quartiles and Boxplots (Non-Calculator)

For each, find the median, the upper and lower quartiles and calculate the interquartile range:

1. *1 4 7 8 9 10 13*
2. *3 3 4 4 5 6 7*
3. *24 20 17 22 18 27*
4. *23 15 22 29 20 21*
5. *8 7 6 11 2 5 4 6 9*
6. *12 14 17 20 9 7 10 8 14*
7. *12 10 9 10 8 5 7 9 13*
8. *7 9 12 4 5 1 8 3 10 1*
9. *19 13 4 18 34 23 4 31 22 17*
10. *18 4 11 1 16 20 14 8 15 14 9*

Applying Question

The age of people watching a late-night horror movie at a cinema are shown.

Ages at Screening

2	0 3 4 6 7 8
3	2 3 8
4	1 4 4 8 9
5	1

4 | 8 means 48 years old *n = 15*

(a) State:
the median
the lower quartile
the upper quartile.

(b) Construct a boxplot for this data.

The skills in this series of exercises appear frequently.

These are the GIFTS you must take to succeed.

Finance and Statistics Unit

Exercise 9

Standard Deviation (Calculator)

Calculate the standard deviation for each:

1.	*19*	*23*	*27*	*28*	*29*	*30*	
2.	*42*	*47*	*48*	*51*	*55*	*57*	
3.	*149*	*151*	*142*	*140*	*158*		
4.	*29*	*31*	*21*	*28*	*31*		
5.	*25*	*31*	*24*	*23*	*37*		
6.	*482*	*480*	*463*	*467*			
7.	*19*	*23*	*27*	*41*	*35*	*20*	*24*
8.	*173*	*168*	*161*	*147*	*156*		
9.	*45*	*56*	*33*	*40*	*44*	*27*	*35*
10.	*27*	*25*	*22*	*29*	*20*	*17*	*28*

Applying Question

The number of goals scored by the top scorer of the teams in the top six split of the Scottish Premier League for season 2023/24 were:

14 15 24 33 11 17

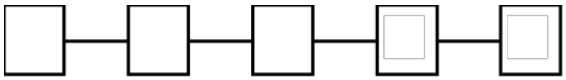
(a) Calculate the mean and standard deviation of the number of goals.

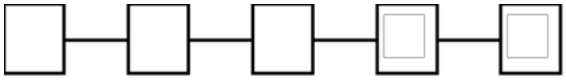
(b) In the bottom six split the mean number of goals by the team top scorer was 7 and the standard deviation was 4·3.

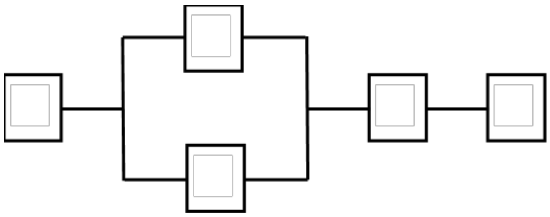
Make 2 valid comments comparing the goals scored by top scorers in the top six and the bottom six.

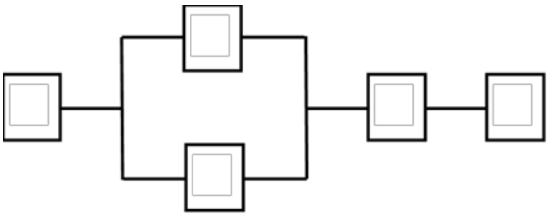
Appendix

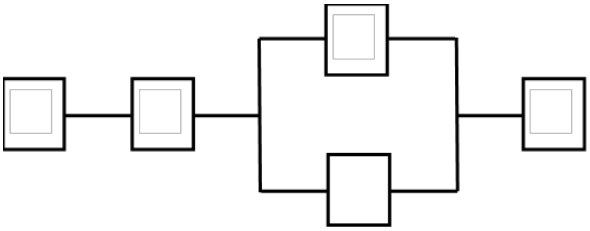
Blank Precedence Tables.

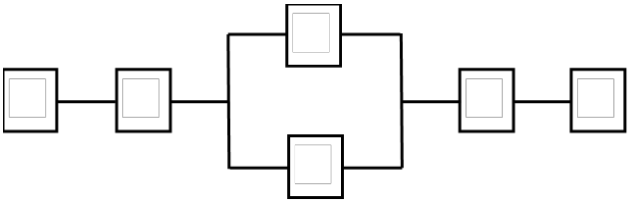
1. 

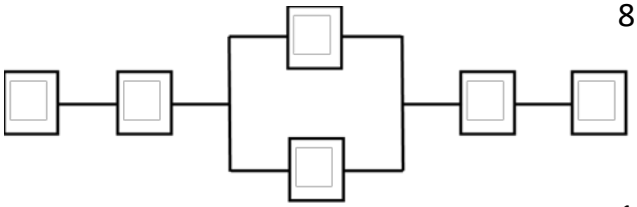
2. 

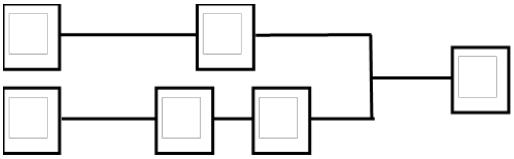
3. 

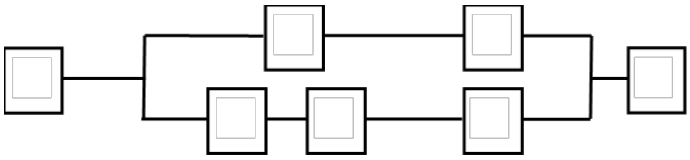
4. 

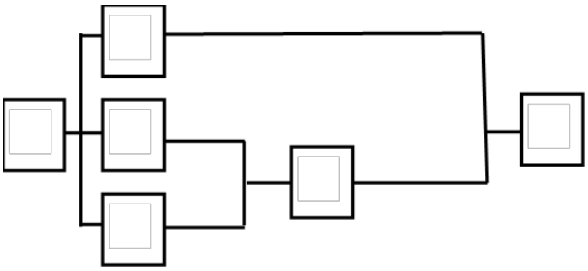
5. 

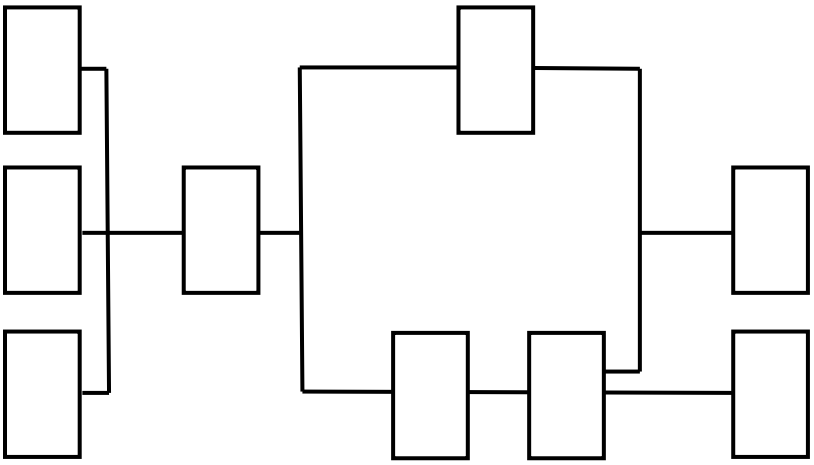
6. 

7. 

8. 

9. 

10. 

AQ. 

Answers

Numeracy: Exercise 1

1	$\frac{29}{35}$
2	$\frac{7}{6}$
3	$\frac{1}{12}$
4	$\frac{19}{9}$
5	$\frac{103}{60}$
6	$\frac{311}{280}$
7	$\frac{9}{28}$
8	$\frac{17}{21}$
9	$\frac{29}{12}$
10	$\frac{13}{18}$
AQ	$\frac{13}{35}$

Numeracy: Exercise 2

1	$\frac{11}{50}$, 0.22
2	$\frac{2}{25}$, 8%
3	15%, 0.15
4	$\frac{11}{20}$, 0.55
5	$\frac{7}{10}$,70%
6	$\frac{4}{5}$, 0.8, 80%
7	$\frac{1}{8}$, 0.125
8	$\frac{27}{40}$, 67.5%
9	0.625, 62.5%
10	0.86, 85.71%
AQ	**1.** 83.38%, $\frac{5}{6}$, 0.832, 0.83 **2.** No; $\frac{9}{16} < \frac{10}{16}$

Numeracy: Exercise 3

1	36%
2	27%
3	12.3%
4	22.7%
5	8.9%
6	45.3%
7	20.8%
8	13.0%
9	53.0%
10	42%
AQ	**1.** 57.9% **2.** 6.0%

Numeracy: Exercise 4

1	£434.55
2	£1968.52
3	23.8km
4	303.92 litres
5	£6267.38
6	175.59mg
7	489.41ml
8	£312393.16
9	619 pupils
10	£433.26
AQ	**1.** £678 **2.** £41000

Numeracy: Exercise 5

1	$\frac{1}{26}$
2	$\frac{1}{3}$
3	$\frac{5}{12}$
4	$\frac{6}{37}$
5	$\frac{15}{36}$
6	$\frac{4}{9}$
7	$\frac{7}{16}$
8	$\frac{6}{25}$
9	$\frac{6}{25}$
10	$\frac{8}{25}$
AQ	**1.** $\frac{1}{6}$ **2.** Dice $\frac{35}{60} > \frac{33}{60}$

Numeracy: Exercise 6

1	6.4 ≈ 6 wins
2	2.4 ≈ 2 workers
3	8.37 ≈ 8 snow days
4	12.92 ≈ 13 flights
5	481.6 ≈ 482 pupils
6	28.8 ≈ 29 eggs
7	7.2 ≈ 7 customers
8	18.75 ≈ 19 pupils
9	28.57 ≈ 29 pupils
10	7.56 ≈ 8 parcels
AQ	More as 6 > 5.037

Numeracy: Exercise 7

1	£13.60
2	689 words
3	35.2 mins (35 min 12 secs)
4	£57
5	22.5 square metres
6	No, should be £3.40
7	36km
8	£15.40
9	480 grams
10	Morrisons (34p/100g is better than 36p/100g)
AQ	£11583

Numeracy: Exercise 8

1	6 hours
2	14 days
3	2 hours 30 mins
4	18 days
5	24 days
6	12 games
7	4 hours 12 mins
8	40 mins
9	8.4 ≈ 9 workers
10	4 hours 30 mins
AQ	20 days, so 9th November

Numeracy: Exercise 9

1	16:40, Total 56
2	80:112, Total 192
3	174:L29, Total 203
4	54:27:81, Total 162
5	60:30:135, Total 225
6	54:30:12, Total 96
7	23:69:92, Total 184
8	60:132:48, Total 240
9	104:56:80, Total 240
10	336:294:210, Total 840
AQ	65:40:45, Total 150

Numeracy: Exercise 10

1	35
2	78
3	175
4	4.8
5	60
6	4.5
7	74
8	13.3
9	80
10	11.6
AQ	2.7 -1.5 = 1.2 bar

G & M: Exercise 1

1	Upper 25.6cm, Lower 25.2cm
2	Upper 3.65m, Lower 3.55m
3	Upper 13.4cm, Lower 12.8cm
4	Upper 19kg, Lower 16.4kg
5	Upper 37.2°C, Lower 36.4°C
6	Upper 390mm, Lower 356mm
7	Upper 3.52cm, Lower 2.88cm
8	Upper 525g, Lower 475 g
9	Upper 21.56cm, Lower 17.64cm
10	Upper 721mm, Lower 679mm
AQ	Upper 4.41g, Lower 3.99g, 30% Rejected

G & M: Exercise 2

1	**416** or 408
2	540 or **570**
3	**176** or 168
4	440 or **455**
5	400 or **455**
6	**144** or 108
7	**144** or 135
8	120 or **128**
9	648 or **720** or **720**
10	**352** or 330 or 320
AQ	**200** or 175

G & M: Exercise 3

1	A = 50.24cm², C = 25.12cm
2	A = 113.04cm², C = 37.68cm
3	A = 226.87cm², C = 53.38cm
4	A = 226.87cm², C = 53.38cm
5	A = 63.59cm², r = 4.5cm, d = 9cm
6	C = 62.8cm, r = 10cm, d = 20cm
7	A = 16.08cm², P = 16.45cm
8	A = 45.78cm², P = 27.76cm
9	A = 10.75cm², P = 13.21cm
10	A = 51.50cm², P = 28.92cm
AQ	Pythagoras gives 12cm A = 152.52cm², P = 54.84cm

G & M: Exercise 4

1	d = 8cm, V = 351.68cm³
2	d = 12cm, V = 489.84cm³
3	d = 7cm, V = 179.50cm³
4	r = 9.3cm, V = 1357.89cm³
5	r = 6.7cm, V = 563.82cm³
6	r = 5.6cm, V = 735.25cm³
7	d = 12.6cm, V = 203.56cm³
8	d = 10.2cm, V = 277.68cm³
9	r = 7.85cm, 1012.62cm³
10	r = 3.55cm, V 344.28cm³
AQ	V = 552.64cm³

G & M: Exercise 5

1	9.49cm
2	13.27cm
3	12.85cm
4	13.42cm
5	22.36cm
6	20.20cm
7	4.79cm
8	28.36cm
9	3.29cm
10	0.97cm
AQ	x = 8.78cm, P = 24.36, Total = 730.8cm/7.31m

G & M: Exercise 6

1	$\frac{6}{11}$
2	$\frac{1}{24}$
3	$\frac{4}{9}$
4	$\frac{9}{47}$
5	$\frac{37}{12}$
6	$\frac{7}{34}$
7	$\frac{3}{50}$
8	$\frac{97}{30}$
9	$\frac{41}{28}$
10	2
AQ	Ramp is not safe as 0.1875>0.187

G & M: Exercise 7

1	1845/6.45pm
2	0917/9.17am
3	0641/6.41am
4	1327/1.27pm
5	0603/6.03am (next day)
6	2355/11.55pm
7	1200/12pm
8	0725/7.25am
9	1115/11.15am
10	0113/1.13am
AQ	2 hours 5 minutes

G & M: Exercise 8

1	4 hours
2	186 miles
3	7 m/s
4	2 hours 30 minutes
5	1512 km
6	12.5 km/h
7	5 hours 20 minutes
8	462 metres
9	3.75 m/sec or 225 m/min
10	3 hours 33 minutes
AQ	4 hours 27 minutes layover

G & M: Exercise 9

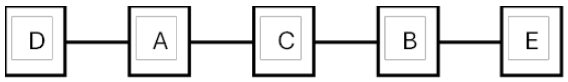
1	See appendix
2	See appendix
3	See appendix
4	See appendix
5	See appendix
6	See appendix
7	See appendix
8	See appendix
9	See appendix
10	See appendix
AQ	See appendix. Not valid as it will take 25 hours.

G & M: Exercise 10

1	5cm by 3cm
2	5cm by 3cm
3	7cm by 2cm
4	8cm by 5cm
5	4cm-1cm-1.5cm-5cm-8cm-5cm-2.5cm
6	10cm-5cm-6cm-6cm-4cm-11cm
7	See sketch
8	See sketch
9	See sketch
10	See sketch
AQ	Ships are 9cm/90km apart

Precedence Tables - Answers.

1.



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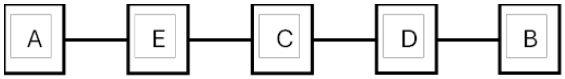

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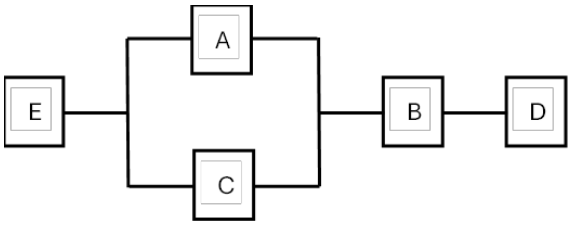

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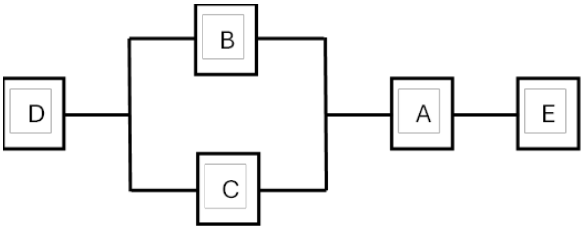

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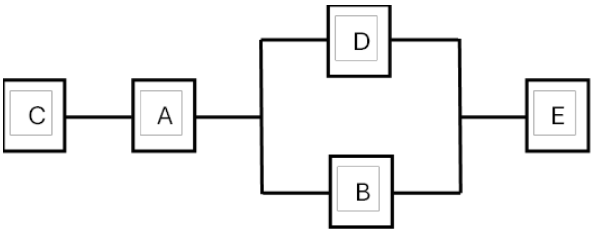

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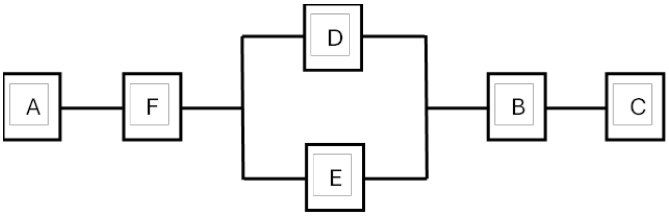

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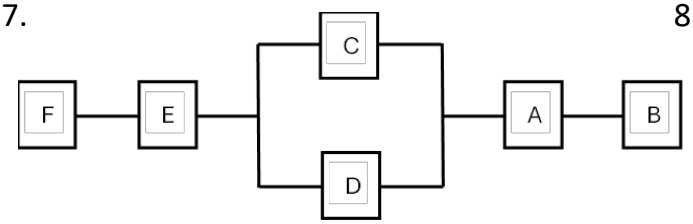

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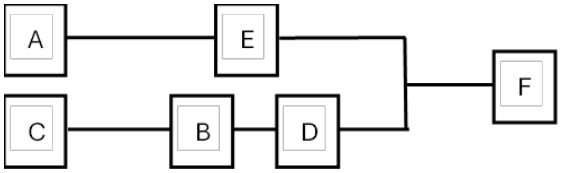

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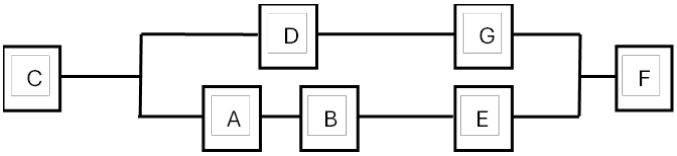

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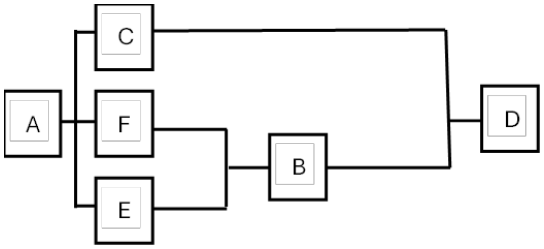
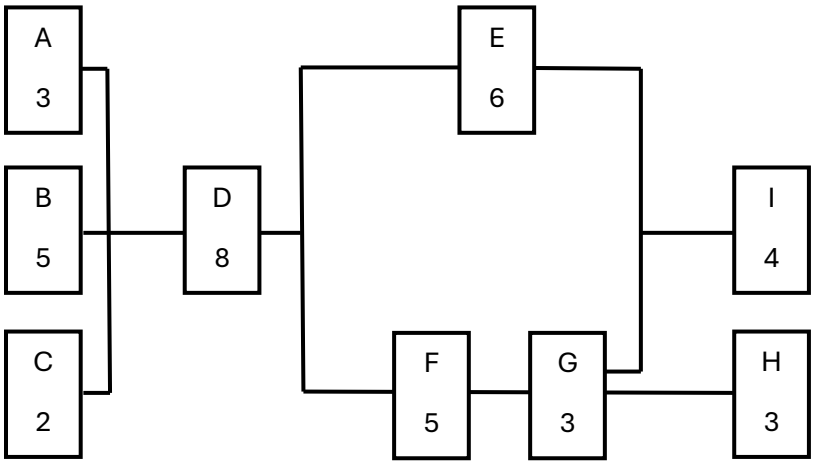


AQ.



F & S: Exercise 1

1	€360
2	606zl
3	598 Czech Koruna
4	£80
5	£88
6	€180
7	2739.60 Albanian LEK
8	2033.20 Czech Koruna
9	368.65zl
10	1663.80 Danish Krone
AQ	1085.75zl

F & S: Exercise 2

1	£961.28
2	£97.28
3	£2449.28
4	£3241.12
5	£2065.28
6	£3027.92
7	£594.88
8	£3030.56
9	£2291.99
10	£3096.91
AQ	a) £782.10 b) £43.21 c) £637.71

F & S: Exercise 3

1	Gross £168 Net £156.75
2	Gross £372 Net £297.60
3	Gross £169.10 Net £149.43
4	Gross £307.50 Net £248.45
5	Gross £214.20 Deductions £42.84
6	Gross £748.60 Net £556.97
7	Wage £11.30 Net £237.98
8	5 overtime hours Deductions £152.37
9	28 Hours Gross £748.80
10	Time and a Half Deductions £144.35
AQ	£839.12

F & S: Exercise 4

1	A £370 **B £365.80** C £378.35
2	A £710 **B £ 665** C £672
3	A £290 B £296 **C £256.50**
4	A £700 **B £682** C £720
5	A £130 **B £120** C £140
6	A £1090 B £1086 **C £1020**
7	A £374 **B £360** C £387
8	A £142 **B £139** C £140
9	**A £336** B £360 C £370
10	A £86.40 **B £84** C £90
AQ	A £201 B £200 **C £198**

F & S: Exercise 5

1	£490.93
2	£319.50
3	£47.99
4	£343.69
5	£33.84
6	£143
7	£117.50
8	£104
9	£30
10	£44
AQ	£150

F & S: Exercise 6

1	75% loss
2	90% profit
3	56% loss
4	22% profit
5	47% loss
6	32% profit
7	85% loss
8	96% profit
9	65% loss
10	19% profit
AQ	£35

F & S: Exercise 7

1	100°, 200° and 60°
2	56°, 160° and 144°
3	162°, 72° and 126°
4	54°, 108° and 198°
5	36°, 108° and 216°
6	84°, 144° and 132°
7	165°, 60° and 135°
8	138°, 120° and 102°
9	200°, 74° and 86°
10	126°, 180° and 54°
AQ	A + B = 15, $\frac{15}{54}$ = 100°, 100°< 120°, False

F & S: Exercise 8

1	M = 8, LQ = 4, UQ = 10, IQR = 6
2	M = 4, LQ = 3, UQ = 6, IQR = 3
3	M = 21, LQ = 18, UQ = 24, IQR = 6
4	M = 21.5, LQ = 20, UQ = 23, IQR = 3
5	M = 6, LQ = 4.5, UQ = 8.5, IQR = 4
6	M = 12, LQ = 8.5, UQ = 15.5, IQR = 7
7	M = 9, LQ = 7.5, UQ = 11, IQR = 3.5
8	M = 6, LQ = 3, UQ = 9, IQR = 6
9	M = 18.5, LQ = 13, UQ = 23, IQR = 10
10	M = 14, LQ = 8, UQ = 16, IQR = 8
AQ	M = 33, LQ = 26, UQ = 44, Boxplot

F & S: Exercise 9

1	$\bar{x} = 26$ s = 4.2
2	$\bar{x} = 50$ s = 5.5
3	$\bar{x} = 148$ s = 7.2
4	$\bar{x} = 28$ s = 4.1
5	$\bar{x} = 28$ s = 5.9
6	$\bar{x} = 473$ s = 9.4
7	$\bar{x} = 27$ s = 8.1
8	$\bar{x} = 161$ s = 10.2
9	$\bar{x} = 40$ s = 9.5
10	$\bar{x} = 24$ s = 4.5
AQ	(a) $\bar{x} = 19$ s = 8.1 (b) on average less goals scored by top scorer in bottom 6. More consistent number of goals scored.