MODEL SOLUTIONS

F

Oxford Cambridge and RSA

GCSE (9–1) Mathematics

J560/03 Paper 3 (Foundation Tier)

Tuesday 12 June 2018 – Morning

Time allowed: 1 hour 30 minutes

You may use:
- a scientific or graphical calculator
- geometrical instruments
- tracing paper

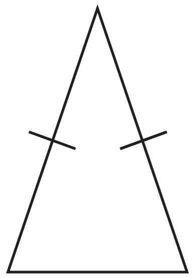
First name	
Last name	
Centre number	
Candidate number	

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Read each question carefully before you start your answer.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the barcodes.

INFORMATION
- The total mark for this paper is **100**.
- The marks for each question are shown in brackets **[ ]**.
- Use the π button on your calculator or take π to be 3.142 unless the question says otherwise.
- This document consists of **20** pages.

Answer **all** the questions.

1 (a) Write down the mathematical name of this triangle.
Choose from the list in the box.

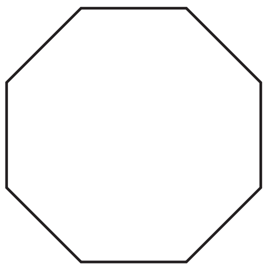


isosceles equilateral right-angled scalene

two sides of equal length.

(a) ....isosceles..........triangle **[1]**

(b) Write down the order of rotation symmetry of this regular octagon.



the number of positions in which the shape looks the same when rotated.

(b) ....8.......... **[1]**

2 (a) Write down.

(i) 3091 rounded to the nearest hundred

$91 > 50$ so round up to nearest 100.

(a)(i) ....3100.......... **[1]**

(ii) 3% as a decimal

% means divide by 100.

$\frac{3}{100} = 0.03$

(ii) ....0.03.......... **[1]**

(iii) the cube root of 27

$\sqrt[3]{27} = 3$

$27 = 3 \times 3 \times 3$

(iii) ....3.......... **[1]**

(b) Complete the statement below using a number from this list.

$-2 \qquad 0 \qquad -6 \qquad 6$

-5 is greater than...

$-5 >$ .... -6 .... **[1]**

(c) Write the following numbers in order of size, smallest first.

0.4 0.5 0.06 0.444 0.46

0.06 .... 0.4 .... 0.444 .... 0.46 .... 0.5 .... **[2]**
smallest

3 Calculate.

(a) $\dfrac{3.6}{1.2 - 0.3}$ (put into calculator)

$$\frac{3.6}{1.2-0.3} = \frac{3.6}{0.9} = 4$$

(a) .... 4 .... **[1]**

(b) $\sqrt{12.25^3}$
Give your answer correct to 1 decimal place.

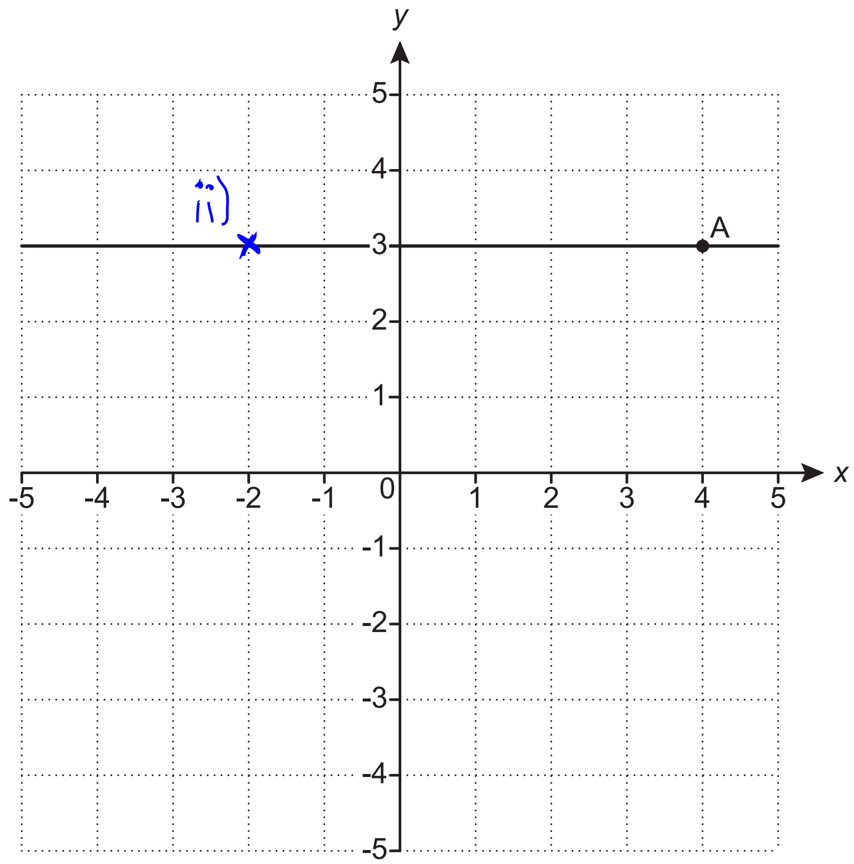
$$\sqrt{(12.25)^3} = \sqrt{1838.265625}$$ (put into calculator)

$= 42.875$ 7 > 5 so round up

$= 42.9$

(b) .... 42.9 .... **[2]**

4 This grid shows a horizontal line going through the point A.



(a) **(i)** Write down the coordinates of point A.

(a)(i) (....4.... , ...3....) **[1]**

(ii) Plot the point ($^-2$, 3). (x, y) **[1]**

(b) Write down the equation of the horizontal line going through point A.

$y = 3$ as all points on the line have y-coordinate 3.

(b) ....$y = 3$.... **[1]**

5 *Tea Biscuits* can be bought in packets of 20 or packets of 24.
All biscuits are identical in size and quality.

20 *Tea Biscuits* for £1.50	24 *Tea Biscuits* for £1.80

Nada says

Better value = cheaper price per biscuit.

The packet of 24 biscuits is better value.

Is Nada correct?
Show how you decide.

£1 = 100p

pack of 20: 1 biscuit = £1.50 ÷ 20 = £0.075 $\xrightarrow{\times 100}$ 7.5p

pack of 24: 1 biscuit = £1.80 ÷ 24 = £0.075 $\xrightarrow{\times 100}$ 7.5p

7.5p = 7.5p

Nada is ......incorrect...... because......the cost of 1 biscuit is the same for both packets, so one packet is not better value than the other. **[3]**

6 You are given that $5y = 4x$.

(a) Find the value of y when $x = 10$.

$5y = 4x$ substitute $x = 10$

$5y = 4(10) = 40$

$\div 5$ $\quad$ $\div 5$

$y = \frac{40}{5} = 8$

(a) $y =$ ....8.......... **[2]**

(b) Write y in terms of x.

$\div 5$ $\quad 5y = 4x$

$y = \frac{4x}{5} = \frac{4}{5}x = 0.8x$

(b) $y =$ ....$0.8x$.......... **[1]**

7 (a) Frances has three cards: Ace (A), King (K) and Queen (Q).
She shuffles these cards and deals them one at a time.

(i) List all the different orders in which she can deal the cards.
One possible order is already shown in the table.
You may not need to use all the rows.

First card	Second card	Third card	
A	K	Q	
A	Q	K	*
K	Q	A	
K	A	Q	
Q	A	K	
Q	K	A	*

[2]

(ii) Find the probability that, in the three cards Frances deals, the King (K) is dealt **immediately** after the Queen (Q).

* King dealt immediately after Queen.

P(K after Q) = $\frac{2}{6}$ ← combinations of Q, K
↖ total combinations

(ii) .... $\frac{2}{6}$ .... **[1]**

(b) A counter has 3 on one side and 5 on the other.
Lena flips the counter.
She then picks one of these three cards at random.

-1 $\quad$ $\times 2$ $\quad$ $+4$

Lena puts the card next to the counter and works out the answer.

For example $\quad 5 \quad \times 2 \quad$ gives the answer 10.

Find the probability that Lena gets an answer **less than 8**.
You must show your working.

Counter	Card	Answer
3	-1	2
3	X2	6
3	+4	7
5	-1	4
5	X2	10
5	+4	9

answers less than 8

number of answers less than 8

P(answers less than 8) = $\frac{4}{6}$

total number of possible answers

(b) ....$\frac{4}{6}$........ [4]

8 Two groups of students go on a water sport holiday.
Each student chooses one activity.

Students in **Group A** choose from Diving, Swimming, Paddleboarding and Kayaking.
Their choices are to be shown in a pie chart.

(a) Complete this table for Group A.

degrees per student
$= 60 \div 5$
$= 12$

swimming: $72 \div 12$
$= 6$ students

Activity	Number of students	Angle of sector
Diving	5	60°
Swimming	10	120°
Paddleboarding	6	72°
Kayaking	9	108°

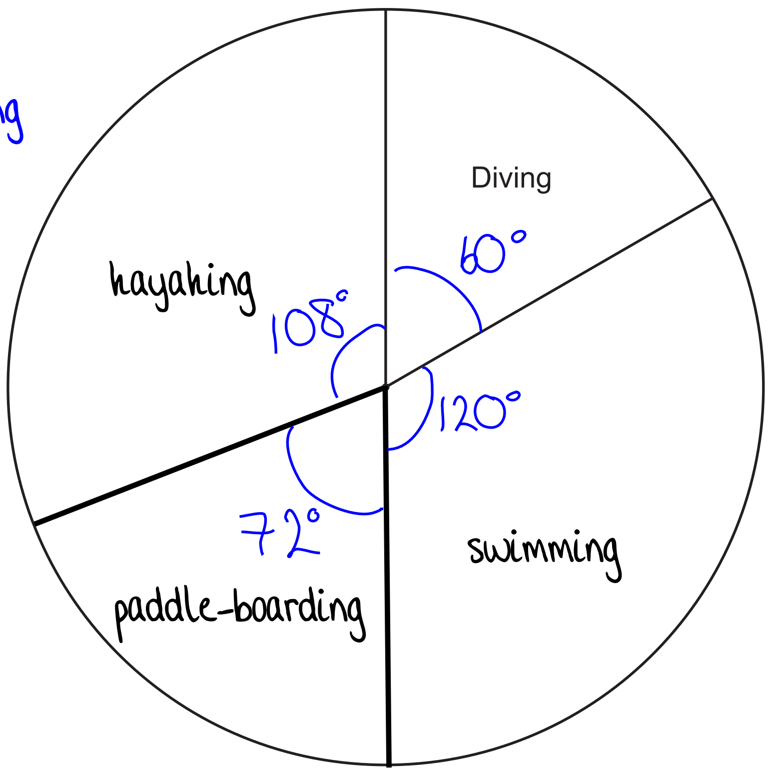
5 students = 60°
×2 ×2
10 students = 120°

360 in total
$360 - 60 - 120 - 108$
$= 72$

[4]

(b) Complete the pie chart for Group A.

Measure angles using a protractor.



[2]

(c) One student in Group A changes activity.
There is now a new modal activity for Group A.

mode = most common

Write down the student's original activity and new activity.

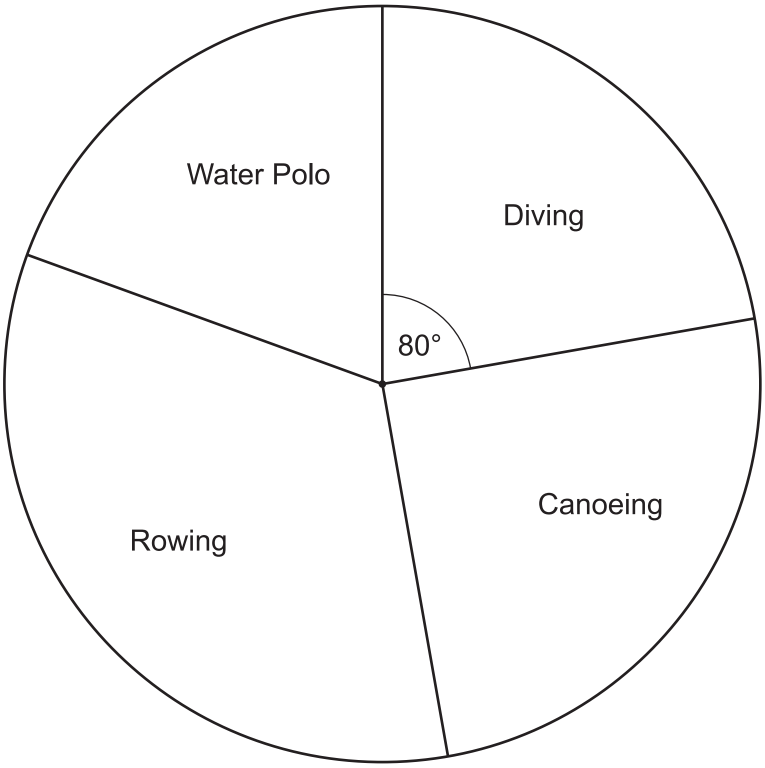
For the modal activity to change, swimming must lose a student. $10 - 1 = 9$ students.

original activity ....swimming............

new activity ....kayaking............ **[1]**

New modal activity needs 10 students to become the mode. $9 + 1 = 10$ so student must change to kayaking.

(d) The choices made by **Group B** are shown in this pie chart.



A teacher thinks more students chose Diving in Group B than in Group A.

Give a reason why the teacher may be wrong.

There may be fewer students in Group B than in Group A

Fewer students means that 1 student represents more degrees. **[1]**

9 The length, a, of a pencil is 15.3 cm, correct to 1 decimal place.

Complete the error interval for the length of the pencil.

Correct to 1 decimal place / to nearest 0.1 / $\pm$ 0.05cm

lower bound = 15.3 - 0.05 = 15.25cm

upper bound = 15.3 + 0.05 = 15.35cm

error interval = $15.25 \leq a < 15.35$

$15.25 \leqslant a < 15.35$ **[2]**

10 4 people take 3 hours to paint a fence.

Assume that all people paint at the same rate.

(a) How long would it take one of these people to paint the same fence?

Number of hours of work = 4 X 3 = 12 hours

1 person would take 12 hours.

(a) ....12.......... hours **[1]**

(b) How long would it take 5 people to paint the same fence?
Give your answer in hours and minutes.

5 people: 12 ÷ 5 = 2.4 hours each

convert 0.4 hours to minutes

0.4 X 60 = 24 minutes

2.4 hours = 2 hours 24 minutes

(b) ....2....... hours ....24....... minutes **[4]**

11 A recipe for flapjacks uses only oats, butter and syrup, in the ratio 3 : 2 : 1.

(a) Pirin makes 1.5 kg of flapjacks.
He uses 600 g of butter.

Has Pirin followed this recipe?
Show how you decide.

600g ÷ 2 = 300g so one part represents 300g.

oats : butter : syrup

×300 3 : 2 : 1 ×300

900g : 600g : 300g

1000g = 1kg

total weight = 900 + 600 + 300 = 1800g = 1.8kg.

No, Pirin has not followed the recipe as he made 1.5kg, which is less than the 1.8kg he should have made using 600g of butter and this recipe. **[4]**

(b) Using this recipe, 200 g of syrup are needed to make 10 flapjacks.
Find the mass of **oats** needed to make **15** of these flapjacks.

grams of syrup for 1 flapjack = 200 ÷ 10 = 20g

15 flapjacks = 20 × 15 = 300g of syrup.

oats : syrup

×300 3 : 1 ×300

900g : 300g

recipe needs 3 times as much oats as syrup

3 × 300g = 900g oats

mass of oats for 15 flapjacks = 900g

(b) ......900...... g **[3]**

12 (a) $\overrightarrow{PQ} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$

Work out $5\overrightarrow{PQ}$.

$$5 \times \overrightarrow{PQ} = 5 \times \begin{pmatrix} 3 \\ 4 \end{pmatrix}$$

multiply top and bottom of the vector by 5

$$= \begin{pmatrix} 5 \times 3 \\ 5 \times 4 \end{pmatrix}$$

$$= \begin{pmatrix} 15 \\ 20 \end{pmatrix}$$

(a) $\begin{pmatrix} 15 \\ 20 \end{pmatrix}$ **[1]**

(b) Find the values of h and k.

$$\begin{pmatrix} h \\ 5 \end{pmatrix} + \begin{pmatrix} 2 \\ k \end{pmatrix} - \begin{pmatrix} 3 \\ 3 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

split top and bottom of vectors

$h + 2 - 3 = 0$ $\qquad$ $5 + K - 3 = 0$

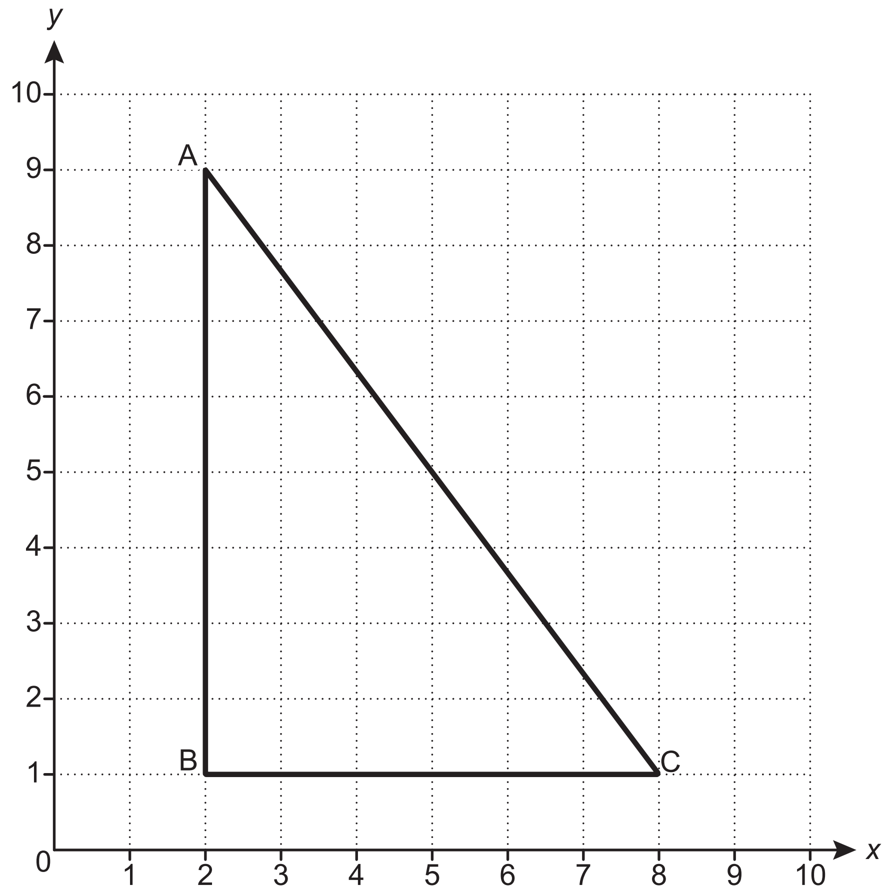
$h - 1 = 0$ $\qquad$ $K + 2 = 0$

$h = 1$ $\qquad$ $K = -2$

(b) $h =$ 1

$k =$ -2 **[2]**

(c) Triangle ABC is drawn on a coordinate grid.



$\overrightarrow{AB} = \begin{pmatrix} 0 \\ -8 \end{pmatrix}$

BC = B to C = 6 squares right = $\begin{pmatrix} 6 \\ 0 \end{pmatrix}$

CA = C to A = 6 squares left = $\begin{pmatrix} -6 \\ 8 \end{pmatrix}$
= 8 squares up

(i) Use the diagram to complete this vector sum.

$$\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA} = \begin{pmatrix} 0 \\ -8 \end{pmatrix} + \begin{pmatrix} 6 \\ 0 \end{pmatrix} + \begin{pmatrix} -6 \\ 8 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

$= \begin{pmatrix} 6-6 \\ -8+8 \end{pmatrix}$

[2]

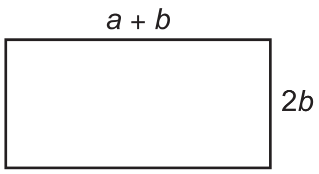
(ii) Give a reason why the answer to the sum could be written down **without doing any working**.

The vectors start and finish at point A.

[1]

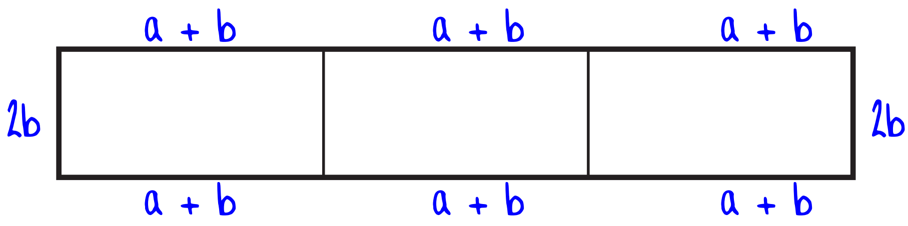
13 In this question, assume all dimensions are in centimetres.

Jess and Pete have many rectangular tiles.
Each tile has length $a + b$ and width $2b$.



Not to scale

(a) Jess joins three tiles together to make a larger rectangle, as shown.



Not to scale

(i) Write an expression for the perimeter of her rectangle.
Give your answer in its simplest form.

perimeter $= 6(a + b) + 2(2b)$

$= 6a + 6b + 4b$

$= 6a + 10b$

(a)(i) .... $6a + 10b$ .... **[2]**

(ii) An expression for the **area** of her rectangle is $6ab + 6b^2$.

Factorise this expression fully.

$6ab + 6b^2 = 6b(a + b)$

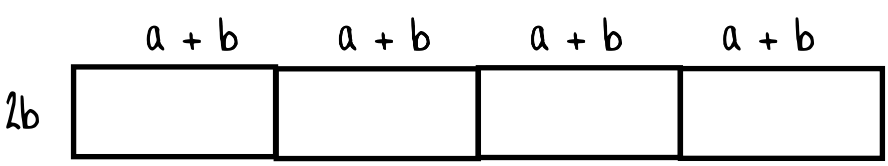
$\underline{6} \times a \times \underline{b}$ $\quad$ $\underline{6} \times \underline{b} \times b$

common factor is $6 \times b$

(ii) .... $6b(a + b)$ .... **[2]**

(b) Pete joins some tiles together to make a different rectangle.
The area of his rectangle is $8ab + 8b^2$.

Draw a possible arrangement of tiles for Pete's rectangle.
Write down expressions for the length and for the width of the rectangle.



area = length $\times$ width

$= (4a + 4b) \times 2b$

$= 8ab + 8b^2$ ✓

length $= 4(a + b)$

$= 4a + 4b$

width $= 2b$

length = ... $4a + 4b$ ....

width = ... $2b$ .... **[5]**

14 Here are the first four terms of a sequence.

6 $\underbrace{\quad}_{+4}$ 10 $\underbrace{\quad}_{+4}$ 14 $\underbrace{\quad}_{+4}$ 18

(a) Write down the next term.

$18 + 4 = 22$

(a) ....22........ **[1]**

(b) Write an expression for the *n*th term.

1st difference = +4 so nth term = 4n + K

the 0th term

n = 0 1 2 3

2 $\underbrace{\quad}_{-4}$ 6 $\underbrace{\quad}_{+4}$ 10 $\underbrace{\quad}_{+4}$ 14

0th term = 6 − 4 = 2

K = 2

nth term = 4n + 2

(b) ....4n + 2........ **[2]**

(c) Explain why 511 is **not** a term in the sequence.

All terms in the sequence are even, and 511 is odd so is not in the sequence.

[1]

(d) Find the term in the sequence that is nearest to 511.

$4n + 2 = 511$

−2 $4n = 511 - 2 = 509$

÷4 $n = 509 \div 4 = 127.25$

n = 127.25 rounds to n = 127 this will be the nearest term.

$4n + 2 = 4(127) + 2$ substitute nearest value of n.

$= 508 + 2$

$= 510$ so the nearest term is 510

(d) ....510........ **[3]**

15 In July the price of a holiday is £500.
In August the price increases by 25%.
In September the price drops to £500 again.

Work out the percentage decrease from the August price to the September price.

August Price:

25% increase = 100% + 25% = 125% = 1.25 multiplier

£500 X 1.25 = £625

$$\% \text{ decrease} = \frac{\text{final} - \text{original}}{\text{final}} \times 100$$

$$= 100 \times \frac{\text{September} - \text{August}}{\text{September}}$$

Percentage Decrease:

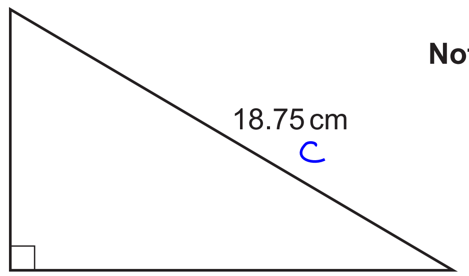
$$= \frac{625 - 500}{625} \times 100$$

$= 0.2 \times 100$

$= 20\%$

.......20....... % **[4]**

16 Here is a right-angled triangle.



Work out the value of x.

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

$5.25^2 + x^2 = 18.75^2$ $) - 5.25^2$

$-5.25^2($ $x^2 = 18.75^2 - 5.25^2 = 324$

$x = \sqrt{324}$

$= 18$

$x =$ ....18....... **[3]**

17 Ping chooses four numbers.

The mode of these four numbers is 8, the range is 7 and the mean is 11.

Find Ping's four numbers.

mode = 8 so at least two of the numbers are 8

sum of all 4 numbers = $4 \times 11 = 44$

$8 + 8 + x + y = 44$ x and y are the two unknown numbers

-16

$x + y = 44 - 16 = 28$

range = 7 so the ~~highest~~ lowest number is $8 + 7 = 15$ — highest — either x or y

$15 + y = 28$

-15

$y = 28 - 15 = 13$

8 , 8 , 13 , 15 **[3]**

18 A box contains only red, blue and green pens.
The ratio of red pens to blue pens is 5 : 9.
The ratio of blue pens to green pens is 1 : 4.

Calculate the percentage of pens that are blue.

red : blue   blue : green

5 : 9   1 : 4

$\div 9$ 9 : 36 $\div 9$

equal number of parts of blue pens to combine ratio

red : blue : green

5 : 9 : 36   so the total number of parts in the ratio is $5 + 9 + 36 = 50$

percentage of blue pens: $\frac{9}{50} \times 100$ blue parts of ratio / total parts of ratio

$= 18\%$

18 % **[4]**

19 Asha worked out $\dfrac{326.8 \times (6.94 - 3.4)}{59.4}$.

She got an answer of 19.5, correct to 3 significant figures.

Write each number correct to 1 significant figure to decide if Asha's answer is reasonable.

$326.8 \sim 300 \qquad 6.94 \sim 7 \qquad 3.4 \sim 3 \qquad 59.4 \sim 60$

$$\approx \frac{300 \times (7-3)}{60}$$

$$= \frac{300 \times 4}{60} = \frac{1200}{60} = 20$$

Asha's answer is reasonable as 19.5 rounds to 20. **[3]**

20 **(a)** Show that $a^5 \times (a^3)^2$ can be expressed as a^{11}. **[2]**

$= a^5 \times a^{3\times2} = a^5 \times a^6$ $\quad (a^3)^2 = a^{3\times2}$

$a^5 \times a^6 = a^{5+6} = a^{11}$

$a^m \times a^n = a^{m+n}$

(b) Write $\dfrac{1}{125} \times 25^9$ as a power of 5.

$\dfrac{1}{125} = \dfrac{1}{5^3} = 5^{-3}$ $\quad a^{-n} = \dfrac{1}{a^n}$

$25^9 = (5^2)^9 = 5^{18}$ $\quad (a^m)^n = a^{m\times n}$

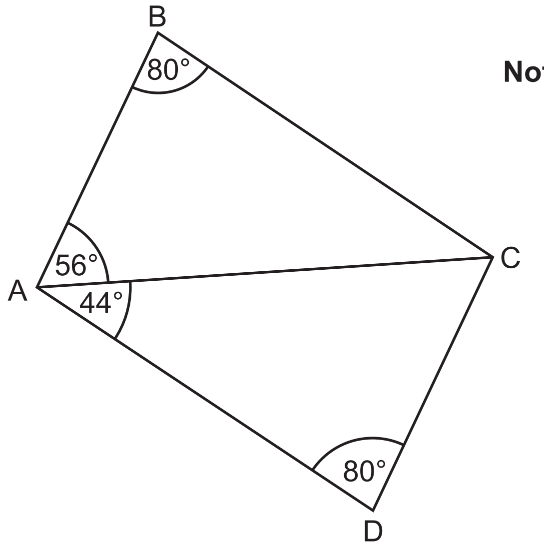
$\dfrac{1}{125} \times 25^9 = 5^{-3} \times 5^{18}$

$= 5^{-3+18}$

$= 5^{15}$ $\quad a^m \times a^n = a^{m+n}$

(b) 5^{15} **[3]**

21 The diagram below shows two triangles.



Prove that triangle ABC is congruent to triangle ACD.

triangle ABC:

angle $A\hat{C}B = 180 - 80 - 56 = 44°$

triangle ACD

angles in a triangle add up to 180°

angle $A\hat{C}D = 180 - 80 - 44 = 56°$

AC is common

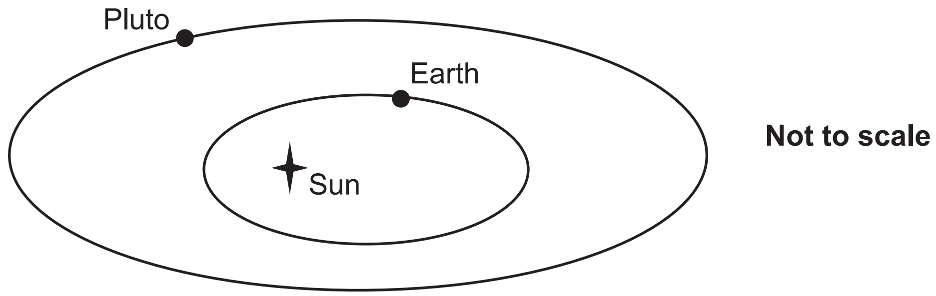
angle $A\hat{C}D$ = angle $B\hat{A}C$

angle $D\hat{A}C$ = angle $A\hat{C}B$

Angle-Side-Angle (ASA) therefore triangle ABC is congruent to triangle ACD.

[4]

22 Earth and Pluto go around the Sun.
Their distance to the Sun varies.



The table shows the closest distance that Earth and Pluto get to the Sun.

	Closest distance to the Sun (km)
Earth	1.47×10^8
Pluto	4.44×10^9

(a) Show that the closest distance of Pluto to the Sun is roughly 30 times the closest distance of Earth to the Sun. **[2]**

$$\frac{\text{closest distance of Pluto to Sun}}{\text{closest distance of Earth to Sun}} = \frac{4.44 \times 10^9}{1.47 \times 10^8}$$

$$= 30.2 = 30 \text{ to 1sf}$$

(b) Give a reason why we **cannot** use this information to say

The distance of Pluto to the Sun is always
30 times the distance of Earth to the Sun.

The distance from Earth and Pluto to the sun varies. **[1]**

END OF QUESTION PAPER