OCR
Oxford Cambridge and RSA

Model Solutions

F

Tuesday 11 June 2019 – Morning

GCSE (9–1) Mathematics

J560/03 Paper 3 (Foundation Tier)

Time allowed: 1 hour 30 minutes

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

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) ____________________

Last name ____________________

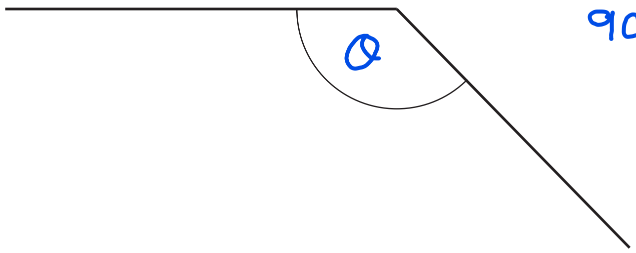
INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Answer **all** the questions.
- Read each question carefully before you start your answer.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is 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).

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 **24** pages.

Answer **all** the questions.

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

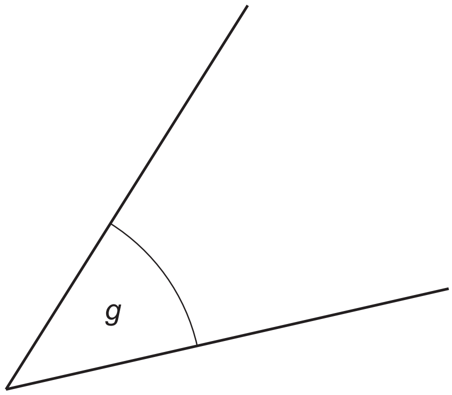
acute	reflex	obtuse	right angle



$90 < \theta < 180$

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

(b) Measure angle *g*.



Use a protractor

(b) ....45..........° **[1]**

2 **(a)** Write 6 : 14 as a ratio in its simplest form.

$$6 : 14 \xrightarrow{\div 2} 3 : 7$$

(a) ....3.......... : ....7.......... **[1]**

(b) The ratio 20 : 50 can be written in the form 1 : *n*.

Find the value of *n*.

$$20 : 50 \xrightarrow{\div 10} 2 : 5 \xrightarrow{\div 2} 1 : 2.5$$

(b) n = ...2.5.......... **[2]**

3 Insert brackets to make each of these calculations correct.

$5 \times (3 - 1) = 10$ $\quad 5 \times (2) = 10$

$(3 + 6 - 2) \div 2 = 3.5$ $\quad 7 \div 2 = 3.5$

[2]

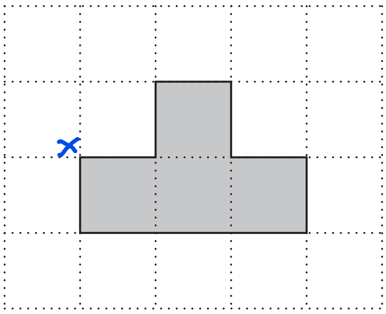
4 Work out 20% of 40.

$$\frac{20}{100} \times 40 = \frac{1}{5} \times 40 = 8$$

$$a\% = \frac{a}{100}$$

..........8.......... **[2]**

5 A shape is drawn on a one-centimetre grid.



(a) Find the perimeter of the shape.

Starting from 'x' clockwise

1+1+1+1+1+1+3+1 = 10cm

(a) ....10.......... cm [1]

(b) How many lines of symmetry does the shape have?

(b) ....1.......... [1]

6 (a) These are the first five multiples of 15.

15 30 45 60 75

Write down the first five multiples of 30.

x2

30 60 90 120 150

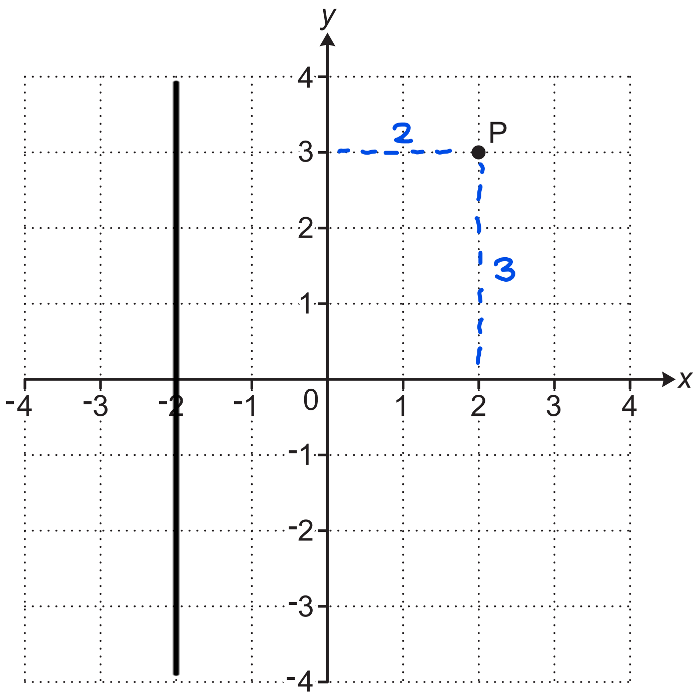
(a) ..30.. , ..60.. , ..90.. , ..120.. , ..150.. [2]

(b) Write down the lowest common multiple (LCM) of 15 and 30.

* Multiples of 15 and 30 have a common '30' ∴ LCM = 30

(b) ....30.......... [1]

7 Point P is shown on this grid.



(a) Write down the coordinates of point P.

(x,y)

(a) (.....2..... , ...3.....) **[1]**

(b) Draw the line $x = {}^-2$ on the grid. **[1]**

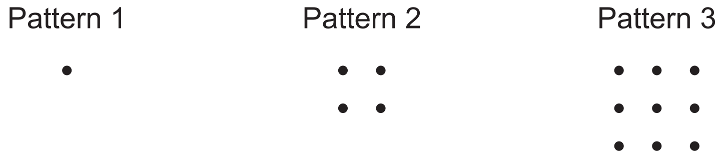
8 Find the value of $3g - h$ when $g = 4$ and $h = 5$.

$3(4) - (5)$

$12 - 5 = 7$

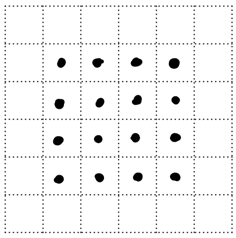
..............................7.............................. **[2]**

9 Here are the first three patterns in a sequence.



(a) Draw Pattern 4 in the sequence.

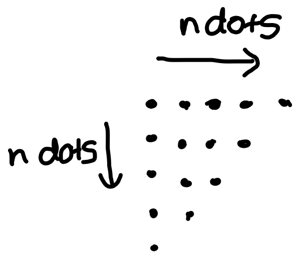
Pattern 4



[1]

(b) Without drawing it, work out how many dots there are in Pattern 8.
Explain how you decide.

Pattern n :



So total dots = $n \times n$ dots.

......64...... dots because ...pattern 8 : 8×8 dots = 64 dots...

....

.... **[2]**

(c) Pattern n has 196 dots.

Find the value of n.

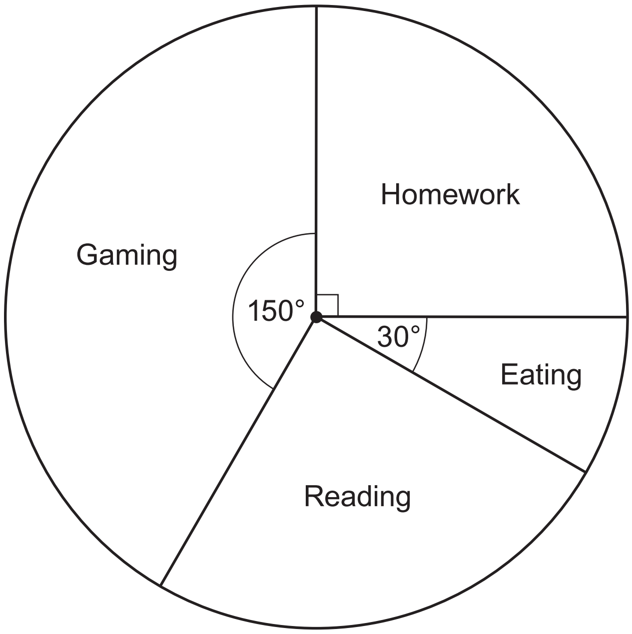
$196 = n^2$

$\sqrt{196} = n$

$14 = n$

(c) n = ...14...... **[1]**

10 The pie chart shows how Jack spent his time one evening.



(a) On which activity did Jack spend most time?

Largest sector of the pie

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

(b) Jack says

I spent $\frac{1}{3}$ of my time on Gaming.

Show that he is not correct.

Proportion of time:

$$\frac{\text{Gaming} \rightarrow 150}{\text{Total} \rightarrow 360} \xrightarrow{\div 3} \frac{50}{120} \xrightarrow{\div 10} \frac{5}{12}$$

$$\frac{1}{3} \xrightarrow{\times 4} \frac{4}{12}$$

Make both values to a common denominator for comparing.

$\frac{5}{12} \neq \frac{4}{12}$. $\therefore$ He is not correct. **[2]**

(c) The pie chart represents 5 hours.

Find the time, in hours and minutes, that Jack spent reading.

angles in a pie chart add up to 360°.

$150 + 90 + 30 + \text{gaming} = 360$

$270 + \text{gaming} = 360$

$\text{gaming} = 360 - 270$

$= 90°$

$360° \rightarrow 5 \text{ hours}$

$\div 4$

$90° \rightarrow \frac{5}{4} \text{ hrs}$

$\frac{5}{4} \text{ hrs} = 1\frac{1}{4} \text{ hrs} = 1 \text{hr } 15 \text{min}$

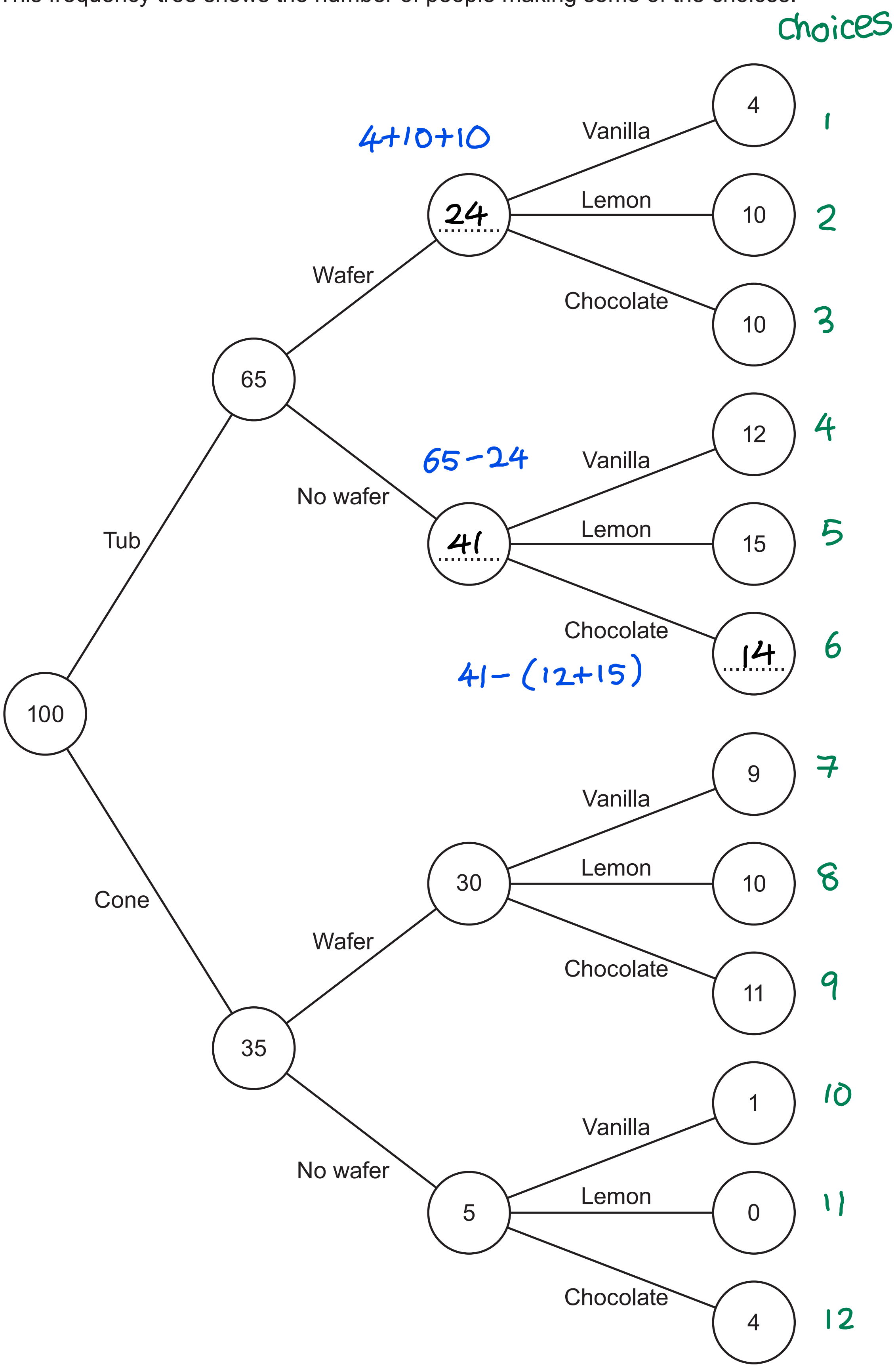
$\frac{1}{4} \times 60 = 15$

$60 \text{ min} = 1 \text{ hour}$

(c) ....1........ h ....15........ min **[4]**

11 Megan's Cafe sells ice cream.
Customers choose to have a tub or a cone, and a wafer or no wafer.
They can choose vanilla, lemon or chocolate ice cream.

This frequency tree shows the number of people making some of the choices.



(a) Anaya buys an ice cream.

One choice she can make is

a cone, no wafer and vanilla.

How many different choices can she make?

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

(b) Complete the frequency tree. **[2]**

(c) Which flavour of ice cream was most popular?
Show how you decide.

Vanilla

4+12+9+1 = 26

Chocolate

10+14+11+4 = 39 → highest

Lemon

10+15+10+0 = 35

(c) ....Chocolate........ **[3]**

12 Solve.

$4x + 5 = 35$

$4x + 5 = 35$ -5

$4x = 30$ $\div 4$

$x = 7.5$

$x =$ ......7.5...... **[2]**

13 Delroy drives 240 miles.
His car averages 40 miles per gallon of petrol.
Petrol costs £1.30 per litre.

1 gallon is 4.5 litres.

How much does Delroy spend on petrol for this journey?

Gallons needed $= \dfrac{\text{distance}}{\text{miles per gallon}} = \dfrac{240}{40} = 6$ gallons

litres needed: $6 \times 4.5 = 27$ L

1 gallon = 4.5 litres

Price : $27 \times £1.30 = £35.10$

price per litre

£ ......35.10...... **[4]**

14 Joan makes cups of tea and coffee at a lunch club.
Each cup requires 250 ml of boiling water.
She has a kettle that boils up to 1.7 litres of water each time.

She boils 10 litres of water in an urn.
She then uses the kettle to boil the rest of the water she needs.

Find the least number of times that Joan needs to boil the kettle to make 56 cups.
Show how you decide.

$1000\,ml = 1\,L$
$250\,ml = \frac{1}{4}\,L$ $\times \frac{1}{4}$

Total boiling water required $= \frac{1}{4} \times 56 = 14$ litres

Total boiling water required from kettle $= 14 - 10 = 4$ litres

from the urn

No. of times the kettle should be boiled $= \frac{4}{1.7}$ ← litres per boil

$= 2.35 \approx 3$ times

rounded up to nearest whole number as there are no fractions in boiling.

3 .... **[5]**

15 (a) 50 sweets weigh 200 g.

If each sweet weighs the same, work out the weight of 7 sweets.

50 sweets → 200g $\div 50$
1 sweet → 4g $\times 7$
7 sweets → 28g

(a) ....28........ g **[2]**

(b) *b* is directly proportional to *a*.
b is 10 when *a* is 8.

Work out *b* when *a* is 9.

$b \propto a$

$b = ka$

Subs $b=10$, $a=8$ $\quad 10 = k(8)$

$k = \frac{10}{8}$

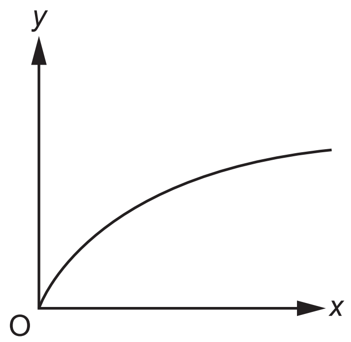
$\therefore b = \frac{10}{8} \times a$

when $a=9$

$\therefore b = \frac{10}{8} \times 9 = \frac{90}{8} \overset{\div 2}{=} \frac{45}{4} = 11.25$

(b) b = ...11.25........ **[2]**

(c) A graph is drawn below.

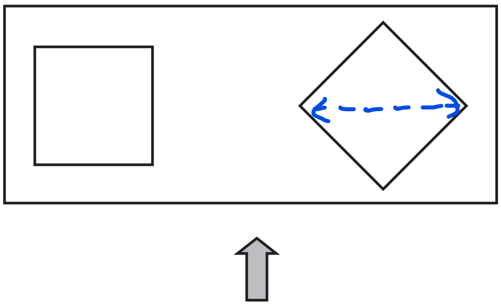


Explain how you know that y is not directly proportional to *x*.

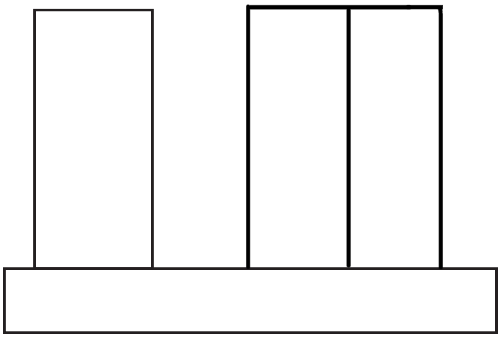
It is not a straight line of constant gradient.

.... **[1]**

16 This is the plan view of a 3D object.



Complete the diagram below to show the front view of the 3D object from A.



The width of the figure should be larger than the length of a side but smaller than length of 2 sides.

[2]

17 A grain of salt weighs 6.48×10^{-5} kg on average.
A packet contains 0.35 kg of salt.

(a) Use this information to calculate the number of grains of salt in the packet.

$$\text{No. of grains} = \frac{\text{Total Salt weight}}{\text{grain of Salt weight}} = \left.\frac{0.35}{6.48 \times 10^{-5}}\right\} \text{Put this in the calculator.}$$

$$= 5401.23 \approx 5400$$

(a) ....5400........ **[2]**

(b) Explain why your answer to part **(a)** is unlikely to be the actual number of grains of salt in the packet.

The average of a grain of Salt may not be the average of all the grains of Salt in the packet. **[1]**

18 Tom researches the weights of plant seeds.

- One poppy seed weighs 3×10^{-4} grams.
- 250 pumpkin seeds weigh 21 grams.
- One sesame seed weighs 3.64×10^{-6} kilograms.

Write the three types of seed in order according to the weight of one seed.
Write the lightest type of seed first.
You must show how you decide.

Weight of one pumpkin seed $= \frac{21}{250} = 0.084\,g$

Convert all values into grams.

one poppy seed $= 3 \times 10^{-4} = 0.0003\,g$

one sesame seed $= 3.64 \times 10^{-6}\,kg = 3.64 \times 10^{-3}\,g = 0.00364\,g$

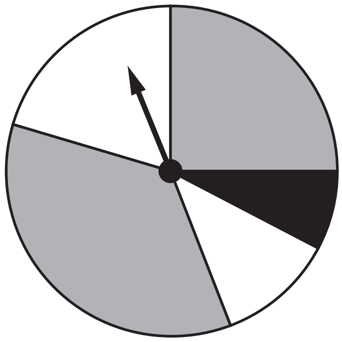
$kg \rightarrow g$: $\times 1000$

Poppy < Sesame < pumpkin

$0.0003 < 0.00364 < 0.084$

........poppy........ , ...sesame... , ...pumpkin....[4]
lightest

19 (a) This spinner has two grey sections, two white sections and one black section.



Vlad says

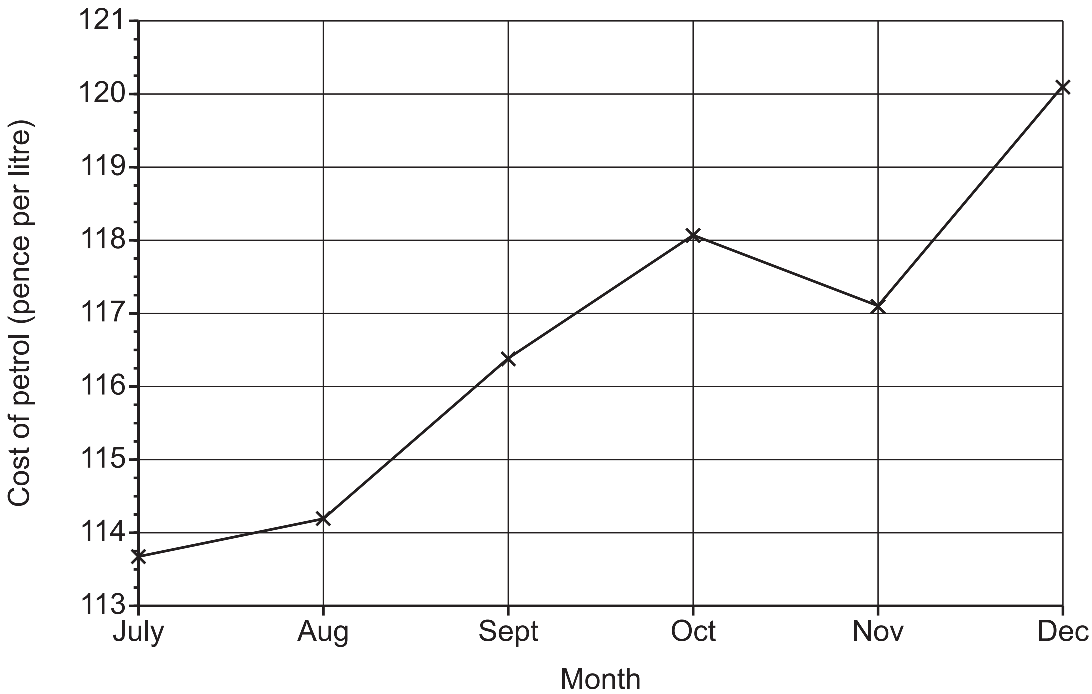
The probability of the spinner landing on black is $\frac{1}{5}$.

Explain why Vlad is not correct.

The angle of the sector black is too small to be $\frac{1}{5}$th of the total.

[1]

(b) The graph shows the cost of a litre of petrol for the last six months of 2017.



Explain why this graph is misleading.

The y-axis does not start from 0.

[1]

20 Sophie is organising a raffle.

- Each raffle ticket costs 50p.
- She sells 400 tickets.
- The probability that a ticket, chosen at random, wins a prize is 0.1.
- Each winning ticket receives a prize worth £3.

Sophie says

I expect the raffle to make over £100 profit.

Show that Sophie is wrong.

Earnings:

$400 \times £0.50 = £200$

Spendings:

Amount of ticket wins = P(win) × no. of tickets

$= 0.1 \times 400 = 40$ wins

cost of winnings = $£3 \times 40 = £120$

Profit:

Earnings − Spendings

$£200 - £120 = £80$.

Sophie is wrong because her profit is less than £100. **[4]**

21 A bag contains some counters.

- There are 300 counters in the bag.
- There are only red, white and blue counters in the bag.
- The probability of picking a blue counter is $\frac{23}{50}$.
- The ratio of red counters to white counters is 2 : 1.

Calculate the number of red counters in the bag.

No. of blue counters = $P(\text{blue}) \times$ no. of counters

$= \frac{23}{50} \times 300$

$= 23 \times 6 = 138$ counters

Red + Blue + White = 300

$R + 138 + W = 300$ $\quad R + W = 162$

$R : W$

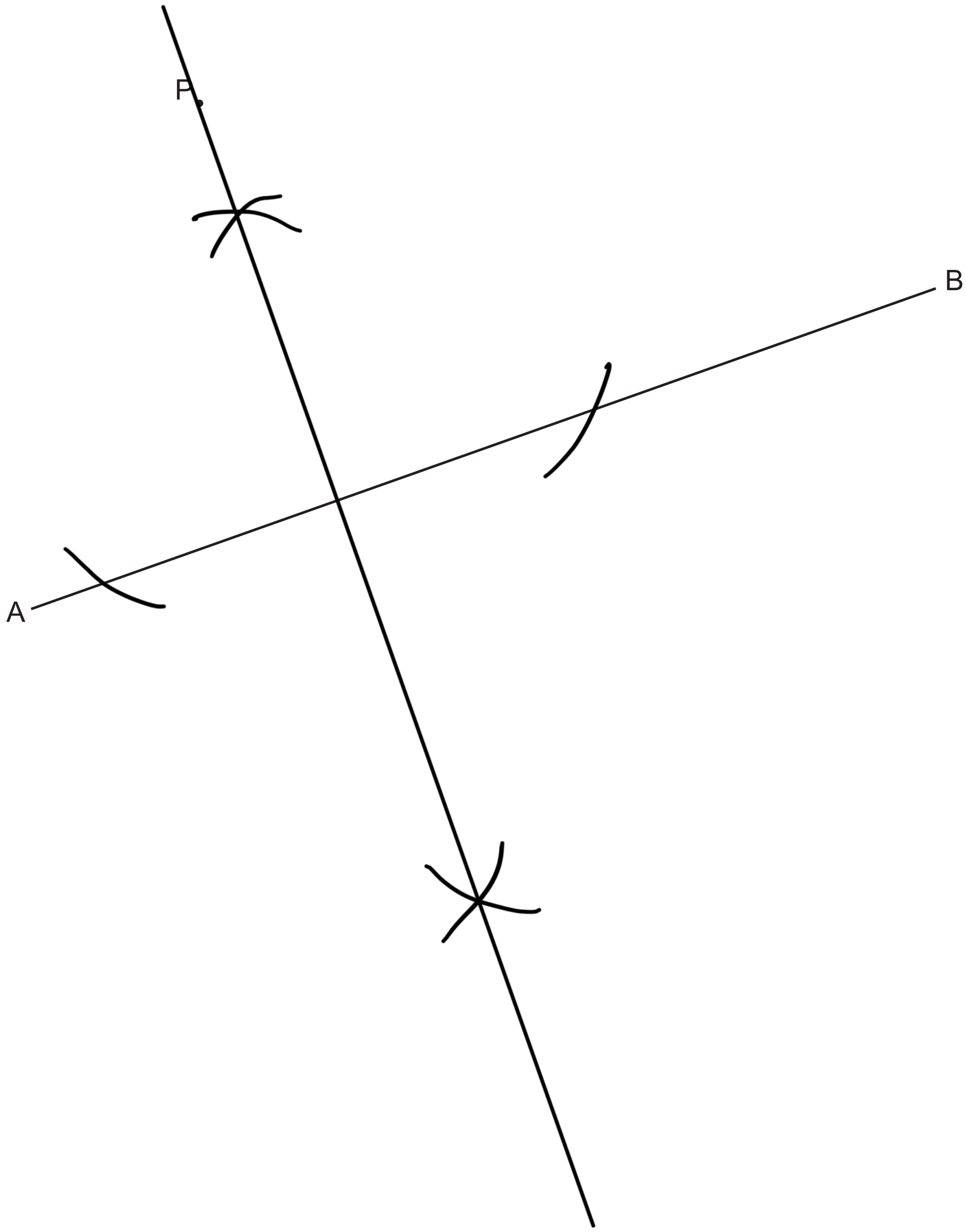
$2 : 1 \rightarrow 3 \text{ parts} \rightarrow \frac{162}{3} = 54$ per part

$2 \times 54 : 1 \times 54$

$108 : 54$

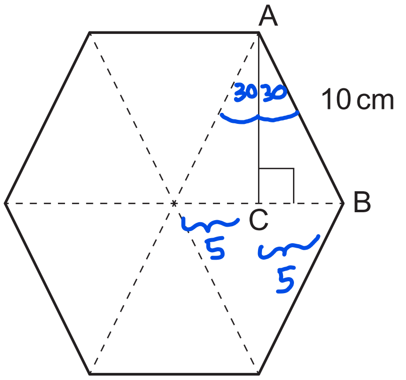
.......................108....................... **[4]**

22 Construct the perpendicular from the point P to the line AB.
Show all of your construction lines.



[2]

23 The diagram shows a regular hexagon made from six equilateral triangles.
Each side is 10 cm.
The angle ACB is a right angle.



Not to scale

(a) Show that AC = 8.66 cm, correct to 3 significant figures. **[4]**

CB = 5cm

$AB^2 = AC^2 + CB^2$ ← Pythagoras theorem $a^2 = b^2 + c^2$

$10^2 = AC^2 + 5^2$

$100 = AC^2 + 25$

$75 = AC^2$

$AC = \sqrt{75} = 8.660 \approx 8.66$ cm (3sf)

(b) **(i)** Show that the area of triangle ACB is 21.7 cm^2, correct to 3 significant figures. **[2]**

$\frac{1}{2} \times 5 \times 8.66$

$= \frac{1}{2} \times 43.3$

$= 21.65 \approx 21.7$ cm^2

Area of triangle $\frac{1}{2} \times b \times h$

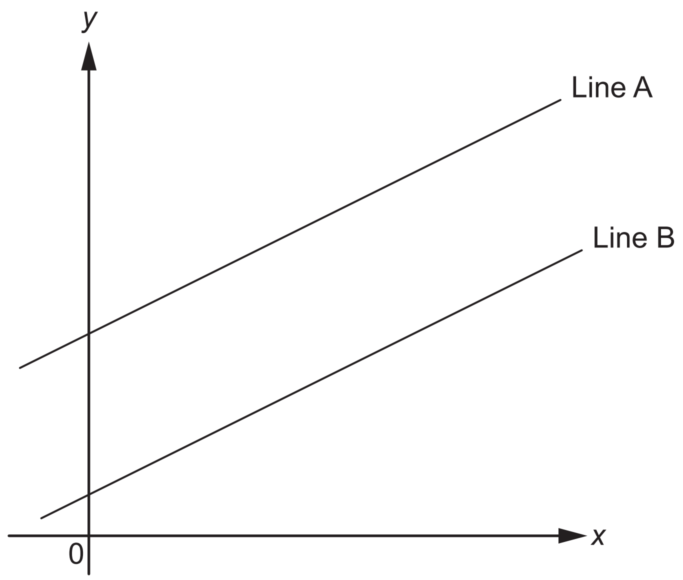
(ii) Find the area of the hexagon, giving your answer to an appropriate degree of accuracy.

Area of 1 Δ $= 2 \times 21.7$
$= 43.4$ cm^2

Area of 6 Δs $= 6 \times 43.4$
$= 260.4$ cm^2
≈ 260 cm^2

(ii) ....260.......... cm^2 **[2]**

24 The graph shows two parallel lines, Line A and Line B.



Not to scale

Line A has equation $y = 6x + 7$.
Line B passes through the point (4, 26).

Find the equation of Line B.

gradient of line B = 6

gradient of line A and B are the same as they are parallel

$y = mx + c$

$y = 6x + c$

Substitute (4, 26)
x y

$26 = 6(4) + c$

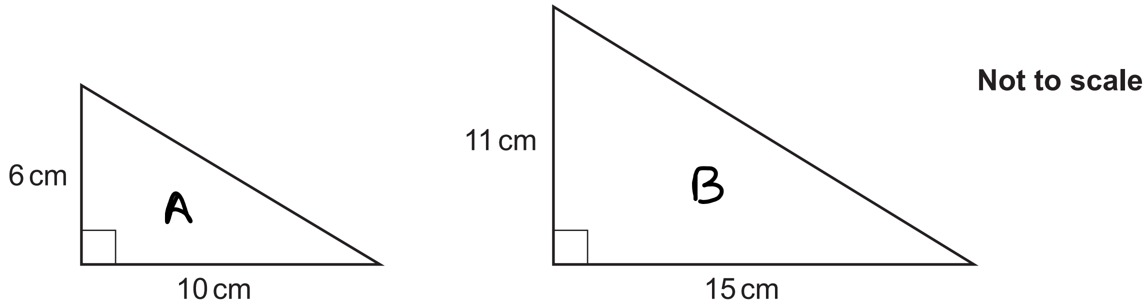
$26 = 24 + c$

$c = 2$

$y = 6x + 2$

$y = 6x + 2$ **[4]**

25 Are these two triangles mathematically similar?
Show how you decide.



Length ratios should be equal in mathematically similar shapes.

Length ratio :

$$A = \frac{6}{10} \xrightarrow{\div 2} = \frac{3}{5} \xrightarrow{\times 3} = \frac{9}{15}$$

$$B = \frac{11}{15}$$

Same denominator.

$$\frac{9}{15} \neq \frac{11}{15}$$

No because corresponding length ratios of A and B are not the same

[3]

26 **(a)** A number, g, is given as 4.05, correct to 2 decimal places.

Complete the error interval for g.

$4.045 \leqslant 4.05 < 4.055$

Smallest value such that it rounds up.

Largest value such that it rounds down

(a) $4.045 \leqslant g < 4.055$ **[2]**

(b) A number, h, is given as 3, truncated to 1 significant figure.

Complete the error interval for h.

$h \leqslant 3.999\ldots\ldots$

$h < 4$

Largest value such that it truncates down to 1 sf.

(b) $3 \leqslant h < 4$ **[1]**

27 Solve by factorising.

$x^2 + 3x - 10 = 0$

$x^2 + \underbrace{5x - 2x}_{3x} - 10 = 0$

$x(x+5) - 2(x+5) = 0$

$(x-2)(x+5) = 0$

$x - 2 = 0 \qquad x + 5 = 0$

$x = 2 \qquad x = -5$

$x = 2$ or $x = -5$ **[3]**

Turn over for question 28

28 **(a)** Simplify.

$a^b \times a^c = a^{b+c}$

$a^0 = 1$

any number

(i) $h^3 \times h^{-3}$

$h^{3+(-3)} = h^{3-3} = h^0 = 1$

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

(ii) $\dfrac{f^9}{f^3}$

$\dfrac{a^b}{a^c} = a^{b-c}$

$f^{9-3} = f^6$

(ii) .... f^6 .... **[1]**

(b) The length of each side of a plastic cube is 2*a* millimetres.
The cube has mass $32a^2$ grams.

Find an expression for the density of the cube in its simplest form.
Give the units of your answer.

Volume of cube $= 2a \times 2a \times 2a$
$= 8a^3$

Volume of cube $= l \times b \times h$

All are the same value

$\text{density} = \dfrac{\text{mass}}{\text{volume}} = \dfrac{32a^2}{8a^3} = \dfrac{4a^2}{a^3} = \dfrac{4}{a}$

(b) density = ... $\dfrac{4}{a}$ ....

units .... g/mm^3 .... **[5]**

END OF QUESTION PAPER