Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number   Candidate Number

Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Time 1 hour 30 minutes

Paper reference **1MA1/3H**

Mathematics

November 2022

PAPER 3 (Calculator)

LH Worked Solutions.

Higher Tier

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator, Formulae Sheet (enclosed). Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.

Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over

Pearson

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Make a the subject of the formula $p = 3a - 9$

$+9$

$p + 9 = 3a$ $\div 3$

$\frac{p+9}{3} = a$

OR $\frac{p}{3} + 3 = a$

$a = \frac{p+9}{3}$

(Total for Question 1 is 2 marks)

2 Rob has been asked to divide 120 in the ratio 3 : 5

Here is his working.

$120 \div 3 = 40$ $120 \div 5 = 24$

Rob's working is not correct.

Describe what Rob has done wrong.

He forget to divide by 8 because there are 8 parts

(Total for Question 2 is 1 mark)

3 200 students chose one language to study.
Each student chose one language from French or Spanish or German.

Of the 200 students,

90 are boys and the rest of the students are girls
70 chose Spanish
60 of the 104 students who chose French are boys
18 girls chose German.

TWO WAY TABLE

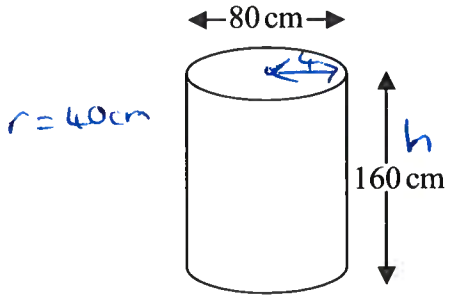
Work out how many boys chose Spanish.

	French	Spanish	German	
Boys	60	22	8	90
Girls	44	48	18	110
	104	70	26	200

22

(Total for Question 3 is 3 marks)

4 Karina has 4 tanks on her tractor.
Each tank is a cylinder with diameter 80 cm and height 160 cm.



The 4 tanks are to be filled completely with a mixture of fertiliser and water.

F : W

The fertiliser has to be mixed with water in the ratio 1 : 100 by volume.
Karina has 32 litres of fertiliser.

1 litre = 1000 cm^3

Has Karina enough fertiliser for the 4 tanks?
You must show how you get your answer.

Volume one tank $= \pi r^2 h$
$= \pi \times 40^2 \times 160$
$= 256000\pi \ cm^3$
$\div 1000$
$= 256\pi$ Litres

F : W
1 : 100

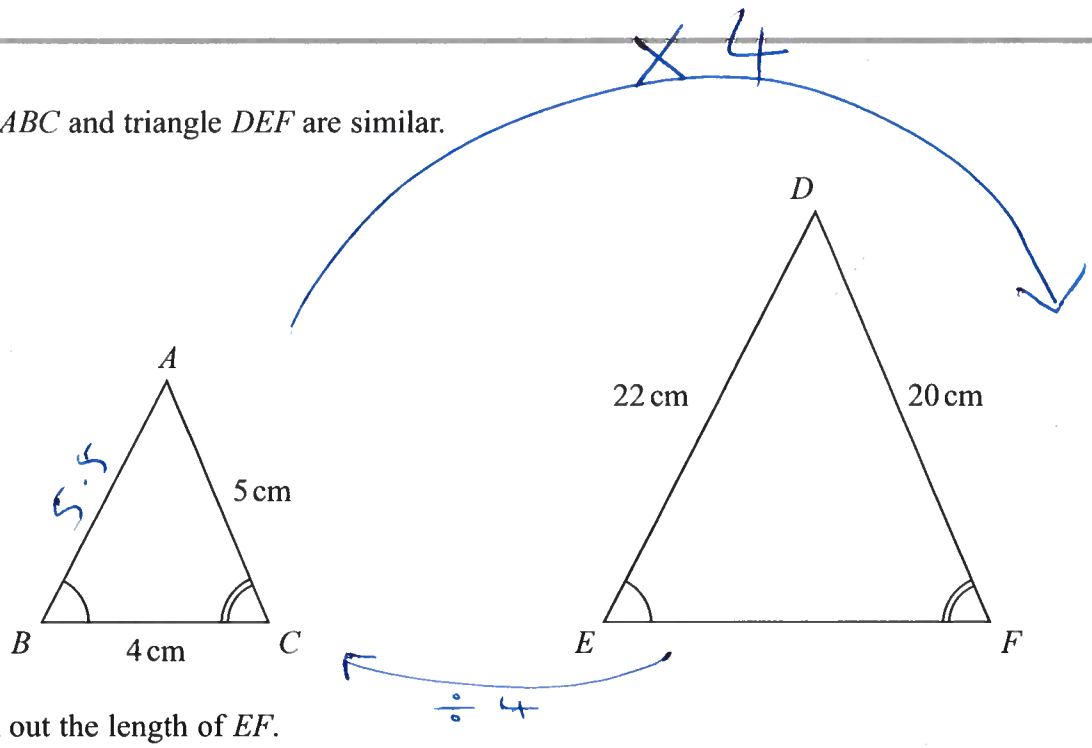
$256\pi \div 101 = 7.96254$ Litres
1×7.96254 Litres needed per tank

4 tanks will need 4×7.96254 Litres
$= 31.85139$ Litres

Karina has 32 Litres of fertiliser so she has enough

(Total for Question 4 is 4 marks)

5 Triangle ABC and triangle DEF are similar.



(a) Work out the length of EF.

4cm × 4 = 16cm

16 cm

(2)

(b) Work out the length of AB.

22 ÷ 4 = 5.5

5.5 cm

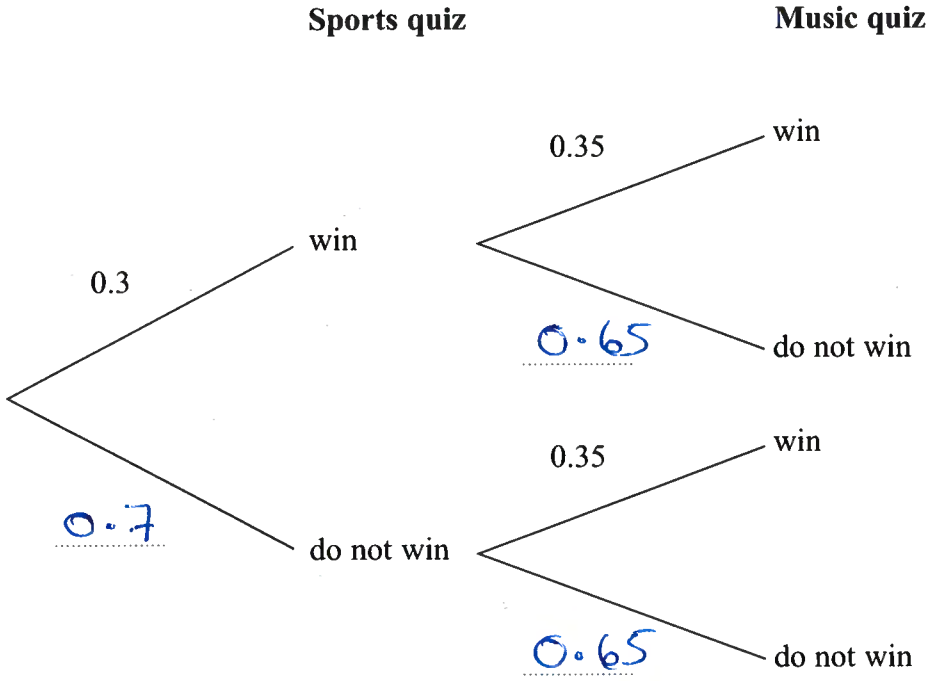
(2)

(Total for Question 5 is 4 marks)

6 One weekend the Keddie family is going to do a sports quiz and a music quiz.

The probability that the family will win the sports quiz is 0.3
The probability that the family will win the music quiz is 0.35

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that the Keddie family will win both the sports quiz and the music quiz.

P(Win Win) = 0.3 × 0.35
= 0.105

0.105

(2)

(Total for Question 6 is 4 marks)

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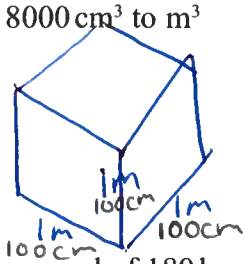
7 (a) Change 8000 cm^3 to m^3



$1m \times 1m \times 1m = 1m^3$

$100cm \times 100cm \times 100cm = 1,000,000cm^3$

$\frac{8000}{1000000}$

0.008 m^3

(1)

(b) Change a speed of 180 km per hour to metres per second.

180 km
×1000
180 000 m

1 hour
×60
60 minutes
×60
3600 seconds

180 km/h = 180 000 m / 3600 seconds

÷3600 ÷3600

= 50 m / 1 second

= 50 m/second

50 metres per second

(3)

(Total for Question 7 is 4 marks)

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8 There are 30 women and 20 men at a gym.

The mean height of all 50 people is 167.6 cm
The mean height of the 20 men is 182 cm

Work out the mean height of the 30 women.

men

$\frac{\text{Total}}{20} = 182$ [×20

Total = 3640 cm

$\frac{\text{Total men} + \text{Total women}}{50} = 167.6$ [×50

Total men + Total women = 8380

3640 + Total women = 8380 [−3640

Total women = 4740 cm

mean women = $\frac{4740}{30}$ = 158 cm

(Total for Question 8 is 3 marks)

---

9 (a) Write 6.75×10^{-4} as an ordinary number.

0.000675

(1)

(b) Work out $\dfrac{2.56 \times 10^{6} \times 4.12 \times 10^{-3}}{1.6 \times 10^{-2}}$

Give your answer in standard form.

$= 659200$

$= 6.592 \times 10^{5}$

(2)

(Total for Question 9 is 3 marks)

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DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

10 Peter has to subtract $(x^2 - 2x - 4)$ from $(x^2 + 3x + 5)$

Here is his working

$$(x^2 + 3x + 5) - (x^2 - 2x - 4)$$
$$= x^2 + 3x + 5 - x^2 - 2x - 4$$
$$= x + 1$$

Explain what is wrong with Peter's working.

He has forgotten to times the terms inside the bracket by -1

He should get $x^2 + 3x + 5 - x^2 + 2x + 4$

$= 5x + 9$

(Total for Question 10 is 1 mark)

11 x and y are integers such that

$3 < x < 8$
$4 < y < 10$
and $x + y = 14$

$x = 4, 5, 6, 7$
$y = 5, 6, 7, 8, 9$

Find all the possible values of x.

$5 + 9 = 14$
$6 + 8 = 14$
$7 + 7 = 14$
$x + y = 14$

$x = 5, 6$ and 7

(Total for Question 11 is 2 marks)

12 Martin used his calculator to work out the value of a number P.
He wrote down the first two digits of the answer on his calculator.

He wrote down 1.2

Complete the error interval for P.

$\leq 1.2\dot{9}$

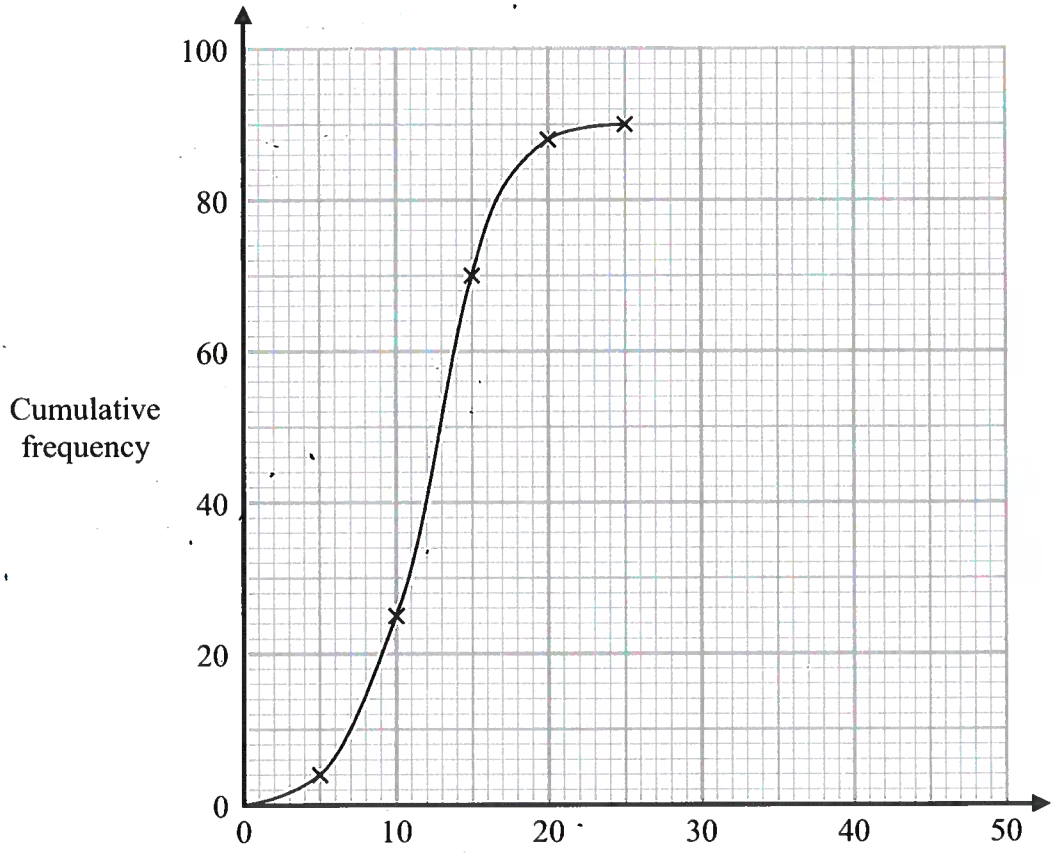
$1.2 \leq P < 1.3$

(Total for Question 12 is 2 marks)

13 Chen has this information about the time that it took an operator at a call centre to answer each of 90 calls.

Time (t seconds)	Cumulative frequency
$0 < t \leqslant 10$	4
$0 < t \leqslant 20$	25
$0 < t \leqslant 30$	70
$0 < t \leqslant 40$	88
$0 < t \leqslant 50$	90

Chen draws this cumulative frequency graph for the information in the table.



Write down two different things that are wrong with this graph.

1 Chen has plotted the midpoint of time (he should have plotted the end point)

2 Chen has not labelled the x-axis (he should have labelled it time).

(Total for Question 13 is 2 marks)

14 (a) Simplify fully $(3x^5y^6)^4$

$= (3)^4 (x^5)^4 (y^6)^4$

$= 81 x^{20} y^{24}$

$81x^{20}y^{24}$

(2)

(b) Expand and simplify $(x + 2)(x - 3)(x + 4)$

$= (x+2)[x^2 + 4x - 3x - 12]$

$= (x+2)(x^2 + x - 12)$

$= x^3 + x^2 - 12x + 2x^2 + 2x - 24$

$= x^3 + 3x^2 - 10x - 24$

$x^3 + 3x^2 - 10x - 24$

(3)

(Total for Question 14 is 5 marks)

15 A pet shop has

7 guppy fish
13 tetra fish
5 angel fish.

David is going to choose one of the following combinations of fish

a guppy fish and an angel fish
or a tetra fish and an angel fish
or a guppy fish, a tetra fish and an angel fish.

Show that there are 555 different ways for David to choose his fish.

G and A = 7 × 5 = 35 ways

OR

T and A = 13 × 5 = 65 ways

OR

G and T and A
= 7 × 13 × 5 = 455 ways +

555 ways

think .... AND × OR +

(Total for Question 15 is 2 marks)

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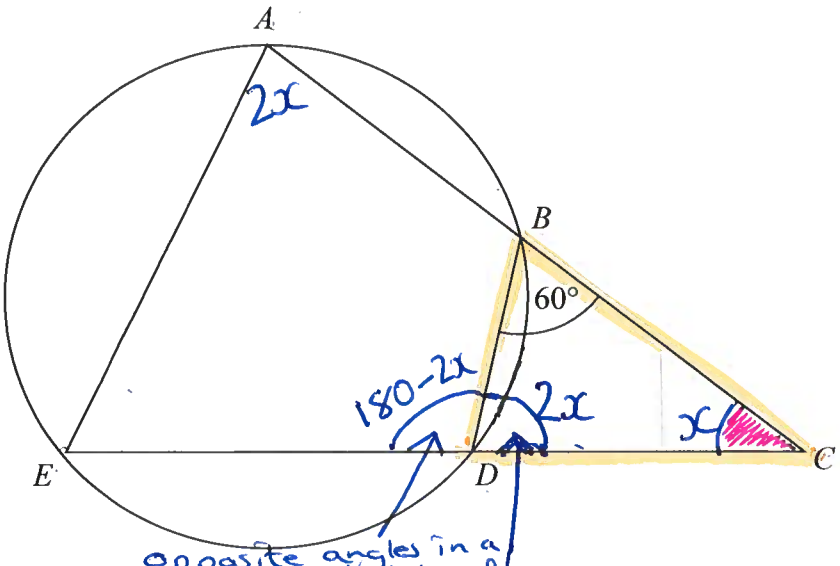
16



ABDE is a cyclic quadrilateral.
ABC and *EDC* are straight lines.
Angle *DBC* = 60°

Given that

size of angle *EAB* : size of angle *BCD* = 2 : 1

work out the size of angle *BCD*.
You must show all your working.

opposite angles in a cyclic quadrilateral add up to 180°

angles on a straight line add up to 180

$180 - (180 - 2x)$
$= 180 - 180 + 2x$
$= 2x$

angles in a triangle add up to 180°

angle BCD + angle CDB + angle DBC = 180°

$x + 2x + 60 = 180°$
$3x + 60 = 180°$
$3x = 120°$
$x = 40°$

°

(Total for Question 16 is 4 marks)

17 There are four boxes on a shelf, **A**, **B**, **C** and **D**.

The total weight of **A** and **B** is 3 times the total weight of **C** and **D**.

The weight of **A** is $\frac{2}{3}$ of the weight of **B**.

The weight of **C** is 75% of the weight of **D**.

Find the ratio

weight of **A** : weight of **B** : weight of **C** : weight of **D**

$A + B = 3(C + D)$

$\frac{2}{3}B + B = 3\left(\frac{3}{4}D + D\right)$

$\frac{2}{3}B + \frac{3}{3}B = 3\left(\frac{3}{4}D + \frac{4}{4}D\right)$

$\frac{5}{3}B = 3\left(\frac{7}{4}D\right)$

$\frac{5}{3}B = \frac{21}{4}D$ [×4

$\frac{20}{3}B = 21D$ [×3

$20B = 63D$ [÷D

$\frac{20B}{D} = 63$ [÷20

$\frac{B}{D} = \frac{63}{20}$

this means that

$B : D = 63 : 20$

$A : B : C : D$

$A : 63 : C : 20$

$\frac{2}{3}(63) : 63 : \frac{3}{4}(20) : 20$

$42 : 63 : 15 : 20$

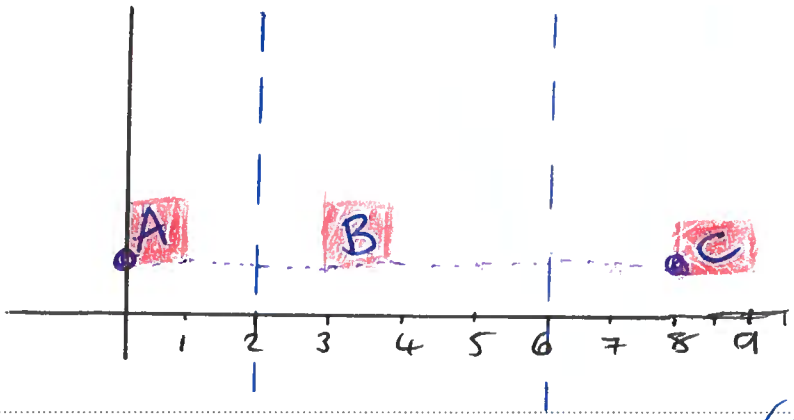
42 : 63 : 15 : 20

(Total for Question 17 is 4 marks)

you don't need all these steps, I'm just showing them to help you see what I've done

18 Shape **A** is reflected in the line with equation $x = 2$ to give shape **B**.
Shape **B** is reflected in the line with equation $x = 6$ to give shape **C**.

Describe fully the **single** transformation that maps shape **A** onto shape **C**.



picture not needed just drawn to show that the shape has moved 8 right.

A → C translation $\begin{pmatrix} 8 \\ 0 \end{pmatrix}$

(Total for Question 18 is 2 marks)

19 There are only blue counters, red counters and green counters in a box.

The probability that a counter taken at random from the box will be blue is 0.4
The ratio of the number of red counters to the number of green counters is 7 : 8

Sameena takes at random a counter from the box.
She records its colour and puts the counter back in the box.
Sameena does this a total of 50 times.

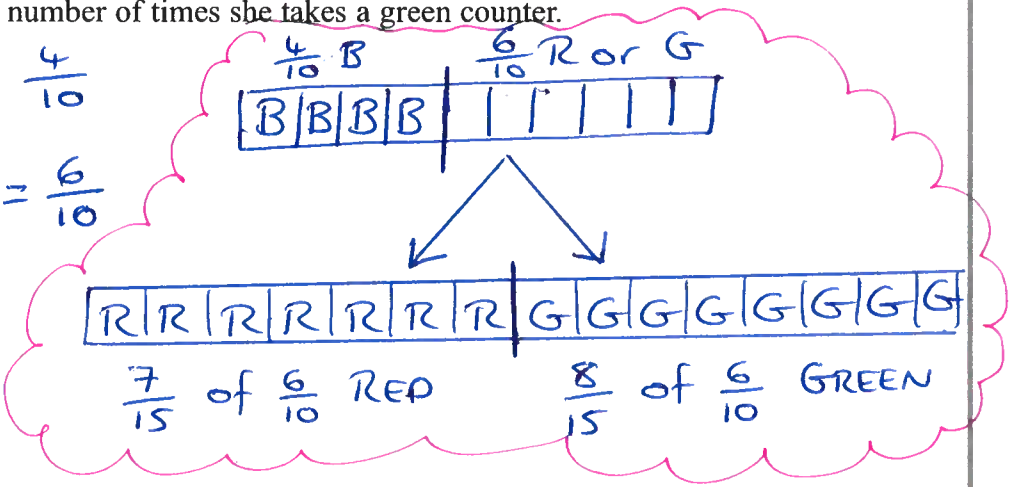
Work out an estimate for the number of times she takes a green counter.

B R G

$P(B) = 0.4 = \frac{4}{10}$

$P(R \text{ or } G) = 0.6 = \frac{6}{10}$

R : G
7 : 8



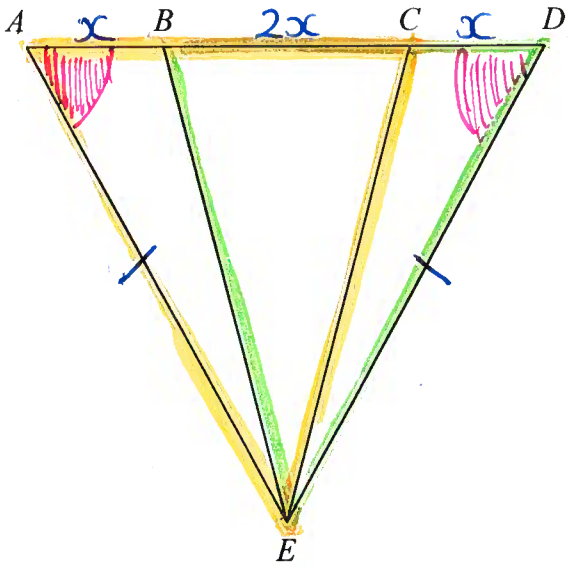
$P(\text{Green}) = \frac{8}{15} \times \frac{6}{10}$

$= \frac{8}{25}$

number greens expected
$= \frac{8}{25} \times 50$
$= 16$

(Total for Question 19 is 3 marks)

20 The diagram shows a triangle ADE.



$AE = DE$

$AB : BC : CD = 1 : 2 : 1$

$x : 2x : x$

Prove that triangle ACE is congruent to triangle DBE.

$AE = DE$ SIDE

$AC = DE = 3x$ SIDE

$E\hat{A}C = E\hat{D}B$ ANGLE

base angles in Isosceles triangle equal

triangles ACE and DBE are congruent

SIDE ANGLE SIDE

SAS

(Total for Question 20 is 3 marks)

21 The equation of a curve is $y = 4x^2 - 56x$
The curve has one turning point.

By completing the square, show that the coordinates of the turning point are $(7, -196)$
You must show all your working.

$y = 4x^2 - 56x$

$= 4(x^2 - 14x)$

complete the square for $x^2 - 14x$

$x^2 - 14x \equiv (x-7)^2 - 49$

$y = 4[(x-7)^2 - 49]$

$= 4(x-7)^2 - 196$

vertical stretch SF 4

right 7

down 196

minimum turning point

at $(7, -196)$

(Total for Question 21 is 3 marks)

22 $\frac{2x+3}{x-5} + \frac{x-4}{x+5} - 3$ can be written in the form $\frac{ax+b}{x^2-25}$ where a and b are integers.

Work out the value of a and the value of b.
You must show all your working.

$$\frac{(2x+3)(x+5)}{(x-5)(x+5)} + \frac{(x-4)(x-5)}{(x+5)(x-5)} - \frac{3(x+5)(x-5)}{(x+5)(x-5)}$$

$$= \frac{(2x+3)(x+5) + (x-4)(x-5) - 3(x+5)(x-5)}{(x-5)(x+5)}$$

$$= \frac{2x^2+13x+15 + x^2-9x+20 - 3(x^2-25)}{(x-5)(x+5)}$$

$$= \frac{2x^2+13x+15 + x^2-9x+20-3x^2+75}{(x-5)(x+5)}$$

$$= \frac{4x+110}{(x-5)(x+5)}$$

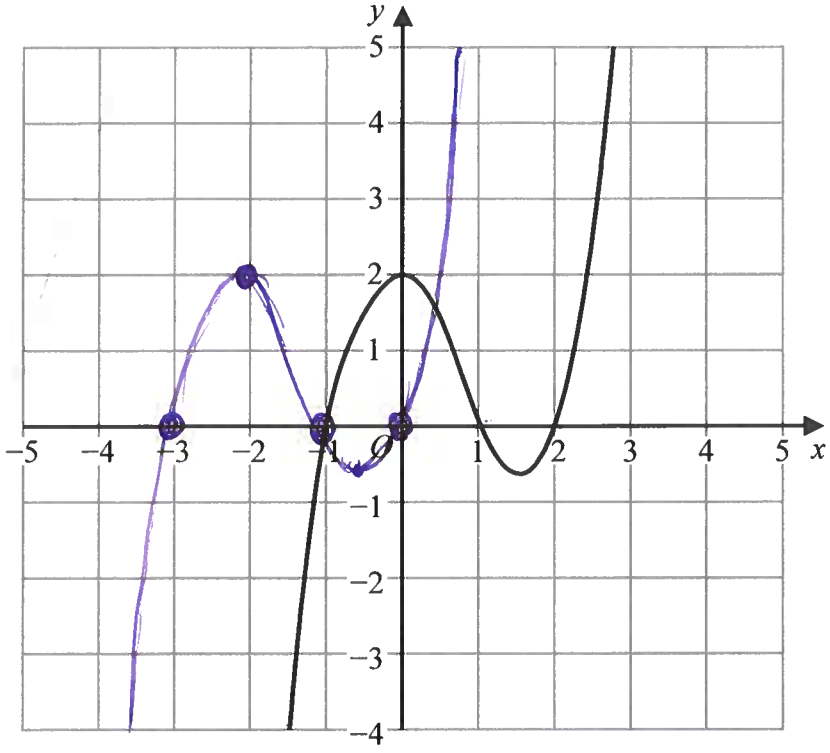
$$= \frac{4x+110}{x^2-25}$$

$a =$ 4

$b =$ 110

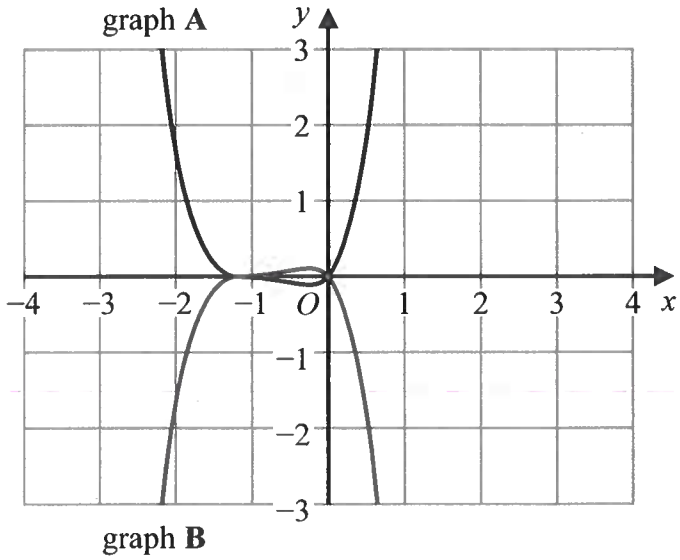
(Total for Question 22 is 3 marks)

23 The graph of $y = f(x)$ is shown on the grid below.



(a) On the grid above, sketch the graph of $y = f(x + 2)$ LEFT 2

(1)



On this grid, graph **A** has been reflected to give graph **B**.
The equation of graph **A** is $y = g(x)$

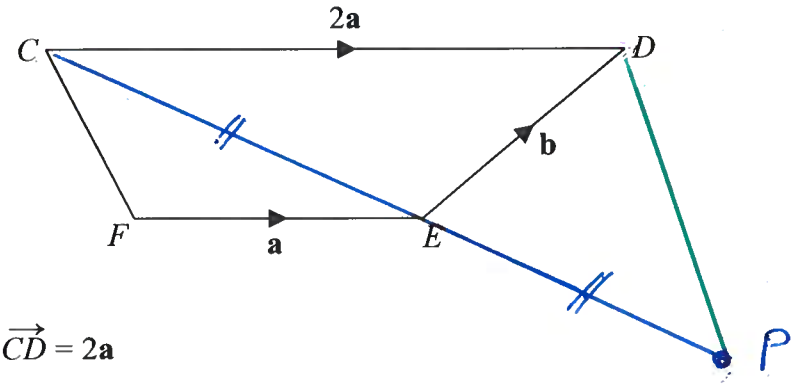
(b) Write down an equation of graph **B**.

$y = -g(x)$

(1)

(Total for Question 23 is 2 marks)

24 $CDEF$ is a quadrilateral.



$\overrightarrow{FE} = \mathbf{a}$ $\overrightarrow{ED} = \mathbf{b}$ $\overrightarrow{CD} = 2\mathbf{a}$

The point P is such that CEP is a straight line and that $CE = EP$

Use a vector method to prove that CF is parallel to DP.

$\overrightarrow{CF} = \overrightarrow{CD} + \overrightarrow{DE} + \overrightarrow{EF}$

$= 2\underset{\sim}{a} - \underset{\sim}{b} - \underset{\sim}{a}$

$= \underset{\sim}{a} - \underset{\sim}{b}$

$\overrightarrow{CE} = \overrightarrow{CD} + \overrightarrow{DE}$

$= 2\underset{\sim}{a} - \underset{\sim}{b}$

$\overrightarrow{EP}$ is collinear with $\overrightarrow{CE}$ (Q states CEP is a straight line) and $CE = EP$

$\therefore \overrightarrow{EP} = \overrightarrow{CE} = 2\underset{\sim}{a} - \underset{\sim}{b}$

$\overrightarrow{DP} = \overrightarrow{DE} + \overrightarrow{EP}$

$= -\underset{\sim}{b} + 2\underset{\sim}{a} - \underset{\sim}{b}$

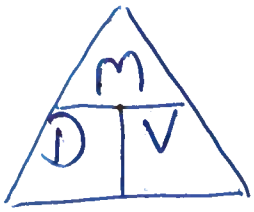
$= 2\underset{\sim}{a} - 2\underset{\sim}{b}$ $\leftarrow 2(\underset{\sim}{a} - \underset{\sim}{b})$

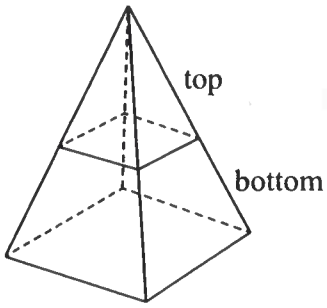
$\overrightarrow{DP} = 2\overrightarrow{CF}$ scalar multiple

(Total for Question 24 is 4 marks)

$\therefore$ CF is parallel to DP

25 The pyramid **P** is formed from two parts made of different materials.





Remember ....
Density is a compound measure and cannot be added!

The top part of **P** has a mass of 92.8 g and is made from material with a density of 2.9 g/cm^3
The bottom part of **P** has a mass of 972.8 g
The average density of **P** is 4.7 g/cm^3

Calculate the volume of the top part of **P** as a percentage of the total volume of **P**.
Give your answer correct to 1 decimal place.
You must show all your working.

	Bottom		Top	Total
Density			2.9	4.7
Mass	972.8	+	92.8	= 1065.6
Volume	194.7	+	32	= 226.7

Step 1

$V_{top} = \frac{m}{D}$

$= \frac{92.8}{2.9}$

Step 2

Total Volume = $\frac{\text{total Mass}}{\text{Average Density}}$

$= \frac{1065.6}{4.7}$

$= 226.7236043$

Step 3

V bottom = 226.7.... − 32
= 196.7236043

Step 4

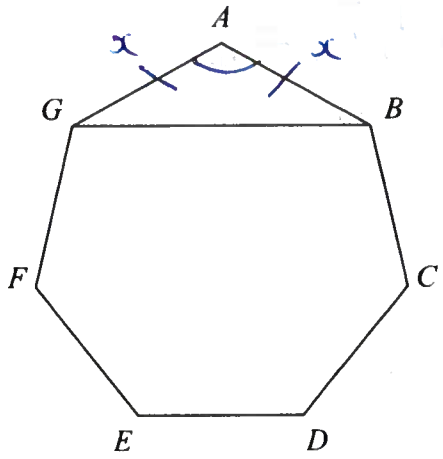
$\frac{V_{top}}{\text{total Volume}} \times 100$

$= \frac{32}{226.7....} \times 100$

= 14.1 % (1dp) %

(Total for Question 25 is 5 marks)

26 *ABCDEFG* is a regular heptagon.



ABG is an isosceles triangle

interior angle of heptagon.

$= \frac{5 \times 180}{7}$

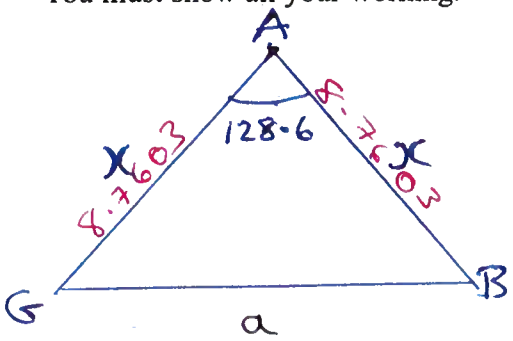
$= \frac{900}{7}$

or 128.5714286°

let $AG = AB = x$

The area of triangle *ABG* is $30\,cm^2$

Calculate the length of *GB*.
Give your answer correct to 3 significant figures.
You must show all your working.



using Sine Rule

Area $ABG = \frac{1}{2} \times x \times x \times \sin \frac{900}{7}$

$30 = \frac{1}{2} x^2 \sin\left(\frac{900}{7}\right)$

$60 = x^2 \sin\left(\frac{900}{7}\right)$

$76.742 = x^2$

$x = 8.7603\ldots$

using cosine rule

$a^2 = x^2 + x^2 - 2 \times x \times x \times \cos\left(\frac{900}{7}\right)$

$= (8.76)^2 + (8.76)^2 - 2(8.76)(8.76)\cos\left(\frac{900}{7}\right)$

$= 249.182567\ldots$

$a = 15.7855\ldots$

$GB = 15.8\ cm$ (3sf) cm

(Total for Question 26 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS