Please check the examination details below before entering your candidate information

Candidate surname	Other names
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Pearson Edexcel
International GCSE

Centre Number	Candidate Number

Thursday 5 November 2020

Morning (Time: 2 hours)	Paper Reference **4MA1/2H**

Mathematics A
Paper 2H
Higher Tier

WORKED SOLUTIONS

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. 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.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used.**
- You must **NOT** write anything on the formulae page.
  Anything you write on the formulae page will gain NO credit.

Information

- The total mark for this paper is 100.
- 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.
- Check your answers if you have time at the end.

Turn over ▶

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P 6 2 6 5 7 A 0 1 2 4

Pearson

International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

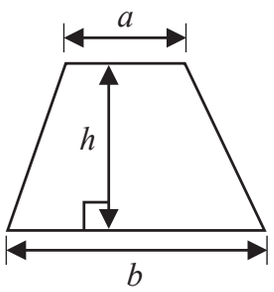
Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

The quadratic equation

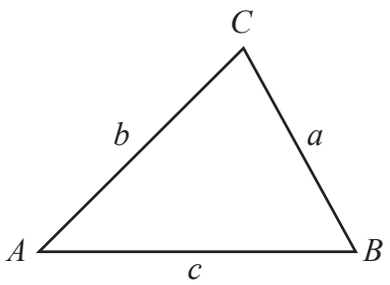
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Area of trapezium $= \frac{1}{2}(a + b)h$



Trigonometry



In any triangle ***ABC***

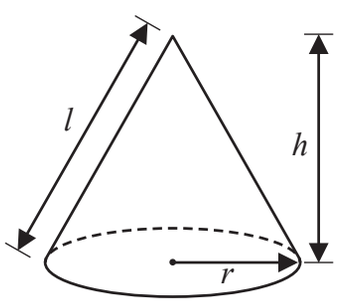
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine Rule $a^2 = b^2 + c^2 - 2bc\cos A$

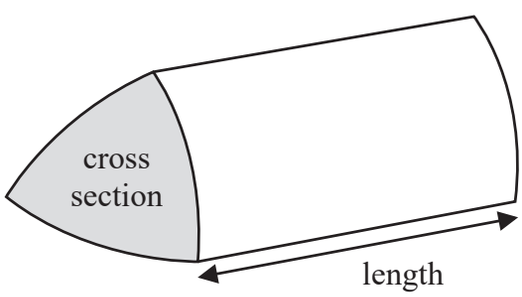
Area of triangle $= \frac{1}{2}ab\sin C$

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

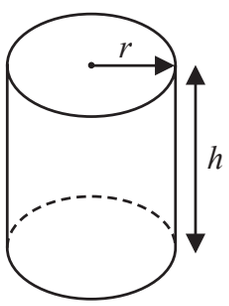
Curved surface area of cone $= \pi rl$



Volume of prism
= area of cross section × length

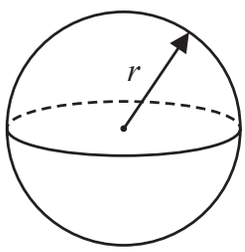


Volume of cylinder $= \pi r^2 h$
Curved surface area of cylinder $= 2\pi rh$



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

Surface area of sphere $= 4\pi r^2$



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Answer ALL TWENTY ONE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Simplify $g^6 \times g^4$

g^{6+4}

g^{10}

(1)

(b) Simplify $k^{10} \div k^3$

k^{10-3}

k^7

(1)

(c) Simplify $(3cd^4)^2$

$3^2 c^2 d^{4\times 2}$

$9c^2d^8$

(2)

(d) Solve the inequality $4x + 7 > 2$

$-7 \quad -7$

$4x > -5$

$x > -\frac{5}{4}$

$x > -1.25$

(2)

(Total for Question 1 is 6 marks)

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2 The table shows information about the lengths of time, in minutes, 120 customers spent in a supermarket.

Length of time (L minutes)	Frequency
$20 < L \leqslant 30$	6
$30 < L \leqslant 40$	26
$40 < L \leqslant 50$	31
$50 < L \leqslant 60$	40
$60 < L \leqslant 70$	17
	120

(a) Write down the modal class.

$50 < L \leq 60$

(1)

(b) Work out an estimate for the mean length of time spent by the 120 customers in the supermarket.

$25 \times 6 + 35 \times 26 + 45 \times 31 + 55 \times 40 + 65 \times 17$

$= 150 + 910 + 1395 + 2200 + 1105$

$= 5760$

Est. Mean $= 5760 \div 120$

$= 48$

48 minutes

(4)

(Total for Question 2 is 5 marks)

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3

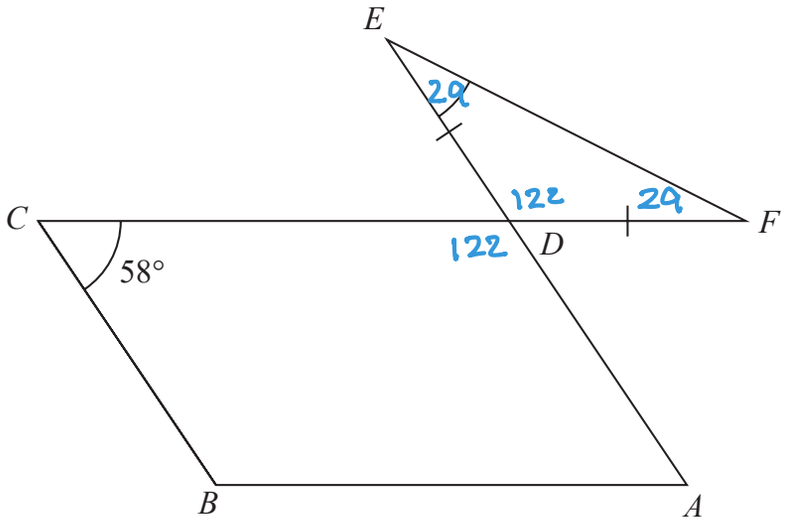

Diagram **NOT** accurately drawn

The diagram shows a parallelogram *ABCD* and an isosceles triangle *DEF* in which *DE* = *DF*

CDF and *ADE* are straight lines.
Angle *BCD* = 58°

Work out the size of angle *DEF*.
Give a reason for each stage of your working.

$C\hat{D}A = 180 - 58$ corresponding angles are equal
$= 122$

$E\hat{D}F = 122$ vertically opposite angles are equal

$D\hat{E}F = D\hat{F}E$ 2 angles in an isosceles are equal

$\frac{180 - 122}{2} = 29$

29 °

(Total for Question 3 is 5 marks)

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4 Andreas, Isla and Paulo share some money in the ratios 3 : 2 : 5

The **total** amount of money that Isla and Paulo receive is £76 more than the amount of money that Andreas receives.

Andreas buys a video game for £48.50 with some of his share of the money.

Work out how much money Andreas has left from his share of the money when he has bought the video game.

A I P

3 2 5

7

76 ÷ 4 = 19

3 x 19 = 57

2 x 19 = 38

5 x 19 = 95

38 + 95 = 133

133 - 57 = 76 ✓

57 - 48·50 = 8·5

£ 8·50

(Total for Question 4 is 4 marks)

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5 Himari's annual salary is 3 130 000 Japanese Yen (JPY).
She gets a salary increase of 4%

(a) Work out Himari's salary after this increase.

3 130 000 × 1·04

3 255 200 JPY

(3)

Kaito bought a car.
The value of the car when Kaito bought it was 750 000 JPY.
At the end of each year, the value of his car had depreciated by 15%

(b) Work out the value of Kaito's car at the end of 3 years.
Give your answer correct to the nearest JPY.

$750\,000 \times 0{\cdot}85^3$

$= 460593{\cdot}75$

4

460 594 JPY

(3)

(Total for Question 5 is 6 marks)

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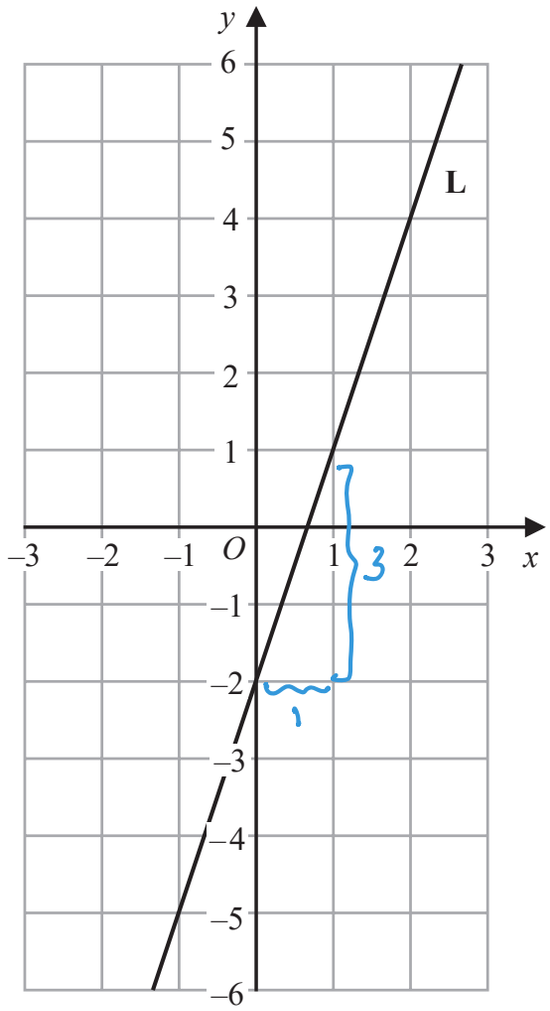
6 The line **L** is shown on the grid.



Find an equation for **L**.

intercept = -2

gradient = $\frac{3}{1}$ = 3

$y = 3x - 2$

(Total for Question 6 is 2 marks)

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7 The diagram shows a right-angled triangle.

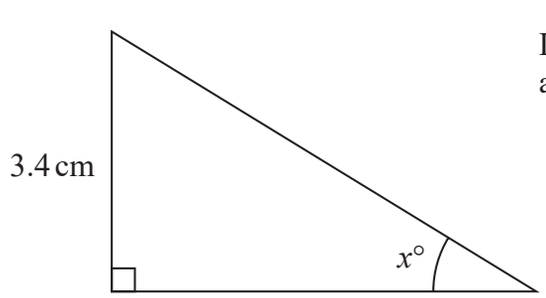

Diagram **NOT** accurately drawn

Calculate the value of x.
Give your answer correct to one decimal place.

$\tan x = \frac{3.4}{4.7}$

$x = \tan^{-1}\left(\frac{3.4}{4.7}\right)$

$= 35.882...$

(1dp)

$x =$ 35.9

(Total for Question 7 is 3 marks)

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8 The diagram shows an isosceles triangle.

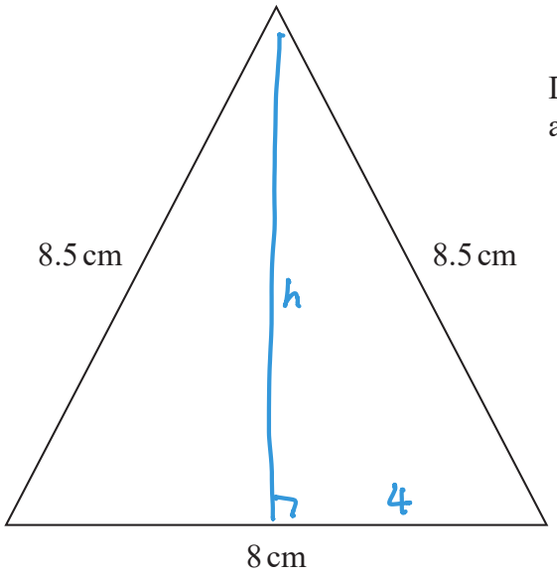

Diagram **NOT** accurately drawn

Work out the area of the triangle.

$h^2 = 8.5^2 - 4^2$

$= 56.25$

$h = \sqrt{56.25}$

$= 7.5$

$\text{Area} = \frac{1}{2} \times 8 \times 7.5$

$= 30$

30 cm^2

(Total for Question 8 is 4 marks)

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9 The diagram shows a solid cylinder with radius 3 m.

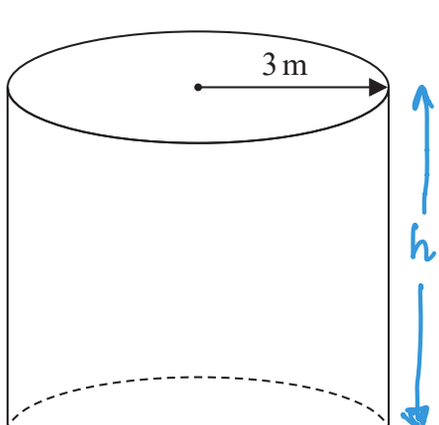

Diagram **NOT** accurately drawn

The volume of the cylinder is 72π m^3

Calculate the **total** surface area of the cylinder.
Give your answer correct to 3 significant figures.

$\pi r^2 \times h = 72\pi$

$3^2 \times h = 72$

$h = \frac{72}{9} = 8$

surface area

$2 \times \pi r^2 + \pi \times d \times h$

$= 2 \times \pi \times 3^2 + \pi \times 6 \times 8$

$= 66\pi$

$= 207.345...$

(3.sf.)

207 ..... m^2

(Total for Question 9 is 5 marks)

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10 The table shows information about the number of minutes each of 120 buses was late last Monday.

Number of minutes late (L)	Frequency
$0 < L \leqslant 10$	10
$10 < L \leqslant 20$	16
$20 < L \leqslant 30$	44
$30 < L \leqslant 40$	29
$40 < L \leqslant 50$	15
$50 < L \leqslant 60$	6

(a) Complete the cumulative frequency table below.

Number of minutes late (L)	Cumulative frequency
$0 < L \leqslant 10$	10
$0 < L \leqslant 20$	26
$0 < L \leqslant 30$	70
$0 < L \leqslant 40$	99
$0 < L \leqslant 50$	114
$0 < L \leqslant 60$	120

(1)

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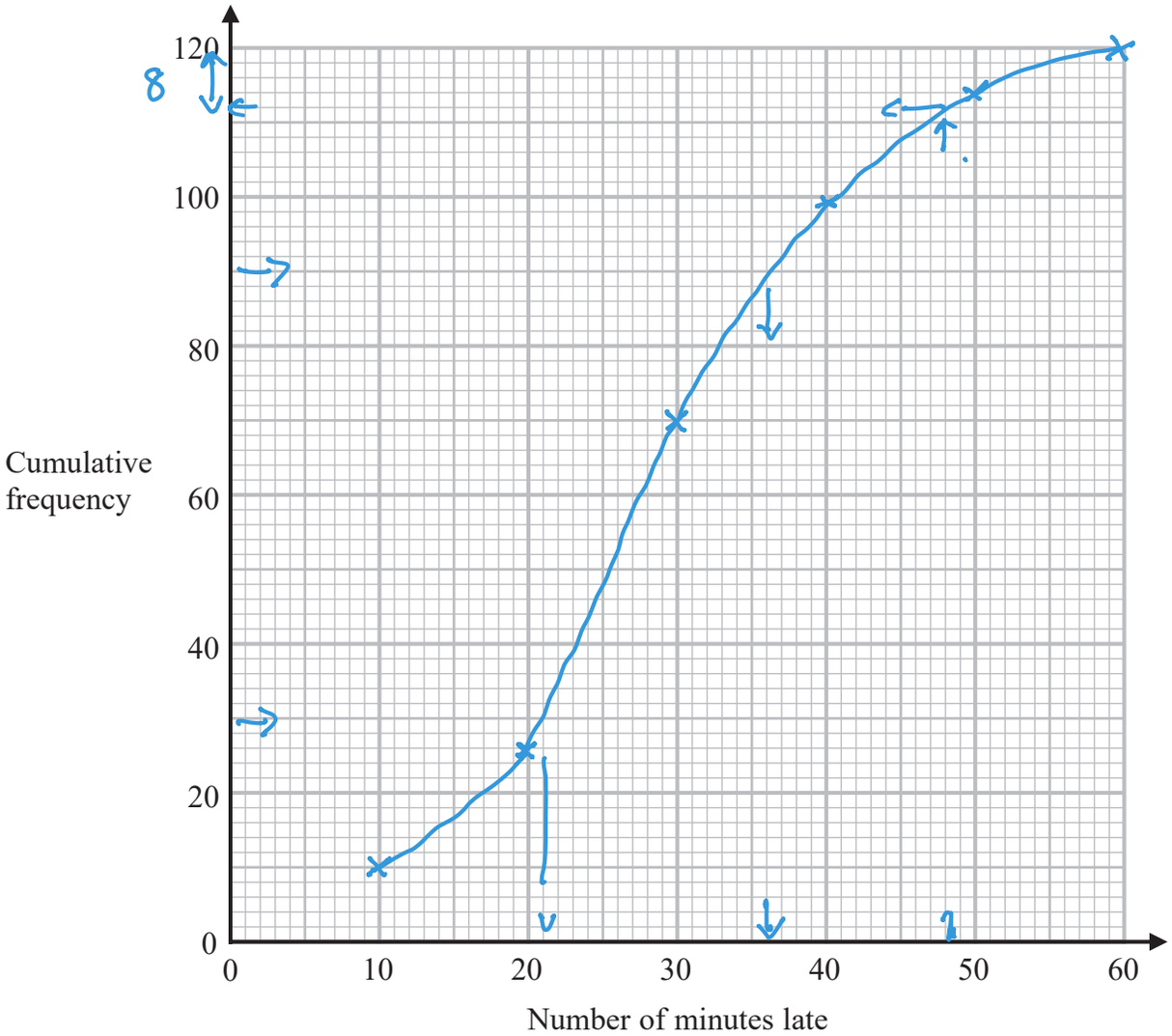
(b) On the grid, draw a cumulative frequency graph for your table.



(2)

(c) Use your graph to find an estimate for the interquartile range.

LQ = 21 UQ = 36

IQR = 36 − 21

15 ..... minutes

(accept 14–18)

(2)

(d) Use your graph to find an estimate for the number of buses that were more than 48 minutes late last Monday.

8 .....

(accept 7–10)

(2)

(Total for Question 10 is 7 marks)

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11 (a) Simplify fully $(8e^{15})^{\frac{2}{3}}$

$(\sqrt[3]{8})^2 \; e^{15 \times \frac{2}{3}}$

$4e^{10}$

(2)

(b) Express $\left(\frac{y}{2}\right)^{-4}$ in the form ay^n where a and n are integers.

$\left(\frac{2}{y}\right)^4 = 2^4 y^{-4}$

$16y^{-4}$

(2)

(c) Solve $\frac{4x-2}{3} - \frac{5-3x}{4} = 6$

Show clear algebraic working.

$12^4 \times \frac{(4x-2)}{3} - \frac{12^3(5-3x)}{4} = 12 \times 6$

$\Rightarrow 16x - 8 - 15 + 9x = 72$

$\Rightarrow 25x = 72 + 23$

$25x = 95$

$x = \frac{95}{25}$

$x = 3.8$

(4)

(Total for Question 11 is 8 marks)

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12 Given that $\frac{3^x}{9^{3x}} = 81$

$9^{3x} = (3^2)^{3x} = 3^{6x}$ $\quad 81 = 3^4$

find the value of x.
Show clear algebraic working.

$$\frac{3^x}{3^{6x}} = 3^4$$

$$3^{x-6x} = 3^4$$

So $x - 6x = 4$

$-5x = 4$

$x = -\frac{4}{5}$

$x =$ -0.8

(Total for Question 12 is 3 marks)

13 Use algebra to show that $0.6\dot{8}\dot{1} = \frac{15}{22}$

$100x = 68.\dot{1}8\dot{1}81...$

$x = 0.6818181...$

$99x = 67.5$

$x = \frac{67.5}{99}$ $\quad x = \frac{675}{990}$

$\div 45$

$\frac{675}{990} = \frac{15}{22}$ as required.

$\div 45$

(Total for Question 13 is 2 marks)

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14 $\mathscr{E}$ = {integers x such that $10 \leqslant x \leqslant 25$}
$A = \{x : x < 18\}$ 10 11 12 13 14 15 16 17
$B = \{x : 13 \leqslant x < 22\}$ 13 14 15 16 17 18 19 20 21

(a) Write down n(A)

8

(1)

(b) List the members of the set $(A \cup B)'$

22 23 24 25

(2)

(c) List the members of the set $A' \cap B$

A' = 18 19 20 21 22 23 24 25
✓ ✓ ✓ ✓

18 19 20 21

(2)

$C \subset A$, $C \subset B$ and n(C) = 5

(d) List the members of the set C

13 14 15 16 17

(1)

(Total for Question 14 is 6 marks)

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15 Make x the subject of $y = \dfrac{5 - 2x}{x + 3}$

$y(x + 3) = 5 - 2x$

$yx + 3y = 5 - 2x$

$yx + 2x = 5 - 3y$

$x(y + 2) = 5 - 3y$

$x = \dfrac{5 - 3y}{y + 2}$

$x = \dfrac{5 - 3y}{y + 2}$

(Total for Question 15 is 4 marks)

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16 Solve the simultaneous equations

$$3xy - y^2 = 8$$
$$x - 2y = 1$$

Show clear algebraic working.

$x = 1 + 2y$

$3 \times (1 + 2y)\, y - y^2 = 8$

$(3 + 6y)y - y^2 = 8$

$3y + 6y^2 - y^2 - 8 = 0$

$5y^2 + 3y - 8 = 0$

$(5y + 8)(y - 1) = 0$

$y = -\frac{8}{5}$ $\qquad$ $y = 1$

$x = 1 + 2\left(-\frac{8}{5}\right)$ $\qquad$ $x = 1 + 2 \times 1$

$= -\frac{11}{5}$ $\qquad$ $= 3$

$= -2.2$

$x = -2.2$ $\qquad$ $x = 3$

$y = -1.6$ $\qquad$ $y = 1$

(Total for Question 16 is 5 marks)

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17 The diagram shows a rectangle.

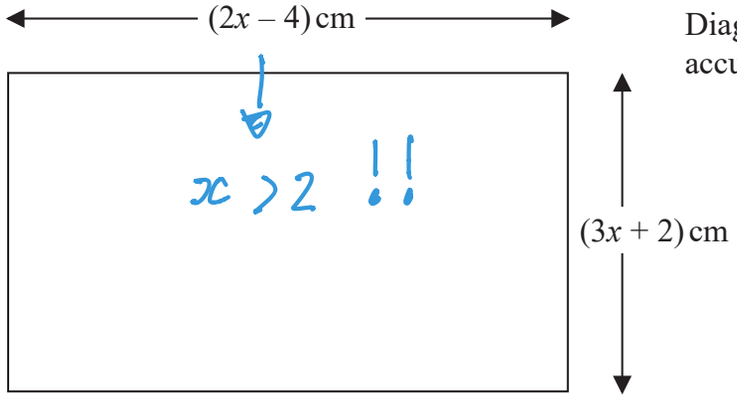

Diagram **NOT** accurately drawn

$x > 2$!!

The area of the rectangle is A cm^2

Given that $A < 3x + 27$
find the range of possible values for x.

$(2x - 4)(3x + 2) < 3x + 27$

$6x^2 + 4x - 12x - 8 - 3x - 27 < 0$

$6x^2 - 11x - 35 < 0$

$(2x - 7)(3x + 5) < 0$

3.5 $\quad$ $-\frac{5}{3}$ not valid

$2 < x < 3.5$

(Total for Question 17 is 5 marks)

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18 The diagram shows cuboid *ABCDEFGH*.

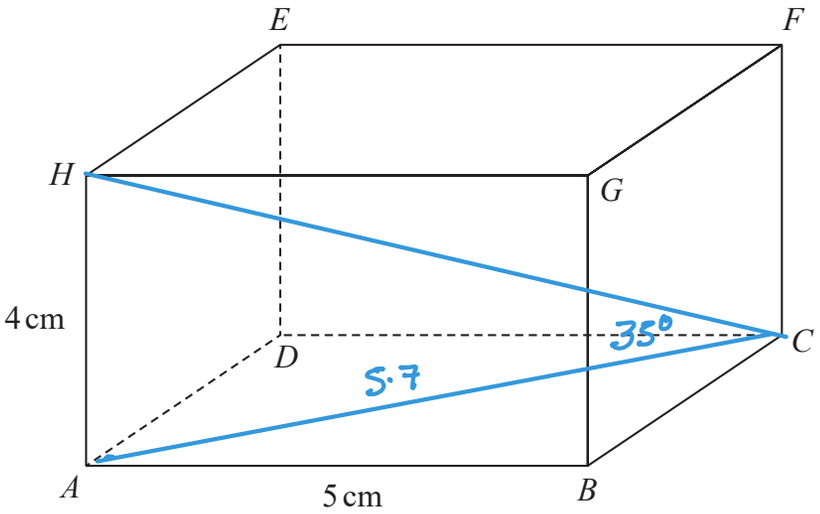

Diagram **NOT** accurately drawn

$AB = 5$ cm
$AH = 4$ cm
The size of the angle between CH and the plane $ABCD$ is 35°

Calculate the volume of the cuboid.
Give your answer correct to 3 significant figures.

$\tan 35 = \frac{4}{AC}$

$AC = \frac{4}{\tan 35} = 5.7125\ldots$

$BC^2 = 5.71^2 - 5^2$

$= 7.6337$

$BC = \sqrt{7.6337}$

$= 2.76\ldots$

Volume $= 2.76\ldots \times 5 \times 4$

$= 55.2583\ldots$

(3sf)

55.3 ..... cm^3

(Total for Question 18 is 5 marks)

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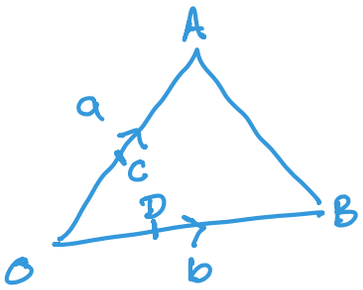
19 OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$ $\overrightarrow{OB} = \mathbf{b}$

The point C lies on OA such that $OC : CA = 1 : 2$
The point D lies on OB such that $OD : DB = 1 : 2$

Using a vector method, prove that $ABDC$ is a trapezium.



$\overrightarrow{AB} = b - a$

$\overrightarrow{OC} = \frac{1}{3}a$ $\overrightarrow{OD} = \frac{1}{3}b$

$\overrightarrow{CD} = \frac{2}{3}a + (b - a) - \frac{2}{3}b$

$= -\frac{1}{3}a + \frac{1}{3}b$

$= \frac{1}{3}(b - a)$

$\therefore$ $\overrightarrow{CD} = \frac{1}{3}\overrightarrow{AB}$ so AB and CD are parallel and ABCD is a trapezium.

(Total for Question 19 is 3 marks)

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20 A bag contains X counters.

There are only red counters and blue counters in the bag.

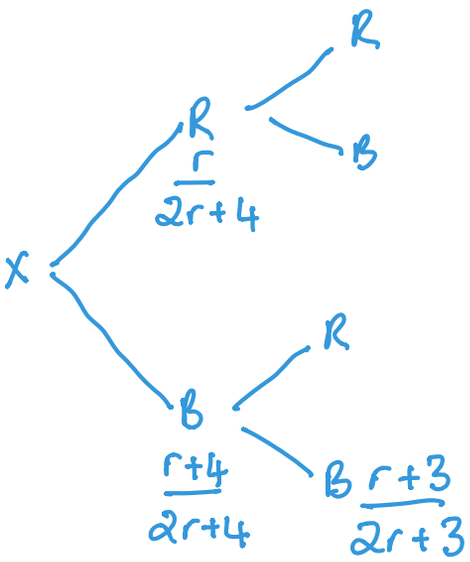
There are 4 more blue counters than red counters in the bag.

Finty takes at random 2 counters from the bag.

The probability that Finty takes 2 blue counters from the bag is $\frac{3}{8}$

Work out the value of X.
Show clear algebraic working.

if red = r blue = r + 4
Total x = $2r + 4$



$$\frac{r+4}{2r+4} \times \frac{r+3}{2r+3} = \frac{3}{8}$$

$$\frac{(r+4)(r+3)}{(2r+4)(2r+3)} = \frac{3}{8}$$

$$\frac{r^2+7r+12}{4r^2+6r+8r+12} = \frac{3}{8}$$

$$8(r^2+7r+12) = 3(4r^2+14r+12)$$

$$8r^2+56r+96 = 12r^2+42r+36$$

$$0 = 4r^2-14r-60$$

$$2r^2-7r-30 = 0$$

$$r = 6$$

$$\therefore \quad x = 2\times 6+4$$
$$= 16$$

16

(Total for Question 20 is 5 marks)

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21 The function f is such that $f(x) = 5 + 6x - x^2$ for $x \leqslant 3$

(a) Express $5 + 6x - x^2$ in the form $p - (x - q)^2$ where p and q are constants.

$5 - (x^2 - 6x)$

$= 5 - [(x - 3)^2 - 9]$

$= 5 - (x - 3)^2 + 9$

$14 - (x - 3)^2$

(2)

(b) Using your answer to part (a), find the range of values of x for which $f^{-1}(x)$ is positive.

$y = 14 - (x - 3)^2$

$(x - 3)^2 = 14 - y$

$x = 3 \pm \sqrt{14 - y}$

$f^{-1}(x) = 3 \pm \sqrt{14 - x}$ but given $x \leq 3$

so $f^{-1}(x) = 3 - \sqrt{14 - x}$

$0 = 3 - \sqrt{14 - x}$

$14 - x = 9$

$14 - 9 = x$

$x = 5$

LBound UB = 14

$5 < x \leq 14$

(5)

(Total for Question 21 is 7 marks)

TOTAL FOR PAPER IS 100 MARKS

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