4H

**Pearson Edexcel
International GCSE**

EDEXCEL
IGCSE

MATHEMATICS A
SOLUTIONS

MAY 2012

4MA0/4H

Disclaimer

These solutions have been produced by Maths4Everyone Limited. While We have used reasonable endeavours to verify the accuracy of these solutions, these solutions are provided on an "as is" basis and We make no warranties of any kind, whether express or implied, in relation to these solutions.

We make no warranty that these solutions will meet Your requirements or provide the results which You want, or that they are complete, or that they are error-free. If You find anything confusing within these solutions then it is Your responsibility to seek clarification from Your teacher, tutor or mentor.

We request that You use the 'contact' link on Our web site to inform Us of any errors or omissions that You find. We will update these solutions and correct errors that We become aware of. We recommend that You check Our web site for the most up-to-date version of these solutions.

The methods used in these solutions, where relevant, are methods which have been successfully used with students. The method shown for a particular question is not always the only method and We do not claim that the method we have used is necessarily the most efficient or 'best' method. We will, from time to time, update a solution to show a different method if We feel that it is a good idea to do so.

Sometimes a method used in these solutions might be unfamiliar to You. If You are able to use a different method to obtain the correct answer then We would usually recommend that You keep using your existing method and not change to the method that We have used here. However, the choice of method is always up to You and We believe that it is often useful if You know more than one method to solve a particular type of problem.

Within these solutions We have indicated where marks **might** be awarded for each question. We have used B marks, M marks and A marks in a similar, but **not identical**, way that the exam board uses these marks within their mark schemes. We have done this for simplicity and convenience. We have sometimes interchanged B marks, M marks and A marks and We have sometimes awarded the marks in different ways to the exam board.

B1 – This is an unconditional accuracy mark (the specific number, word or phrase must be seen. This type of mark cannot be given as a result of 'follow through').

M1 – This is a method mark. We have indicated where method marks might be awarded for the method that is shown. If You use a different method, then the same number of method marks would be awarded but We are not able to indicate for what the marks would be awarded for Your particular method. When appropriate, You should seek clarity and download the relevant examiner mark scheme from the exam board's web site

A1 – These are accuracy marks. Accuracy marks are typically awarded after method marks. If the correct answer is obtained, then You should normally (but not always) expect to be awarded all of the method marks (provided that You have shown Your method) and all of the accuracy marks.

Work out the value of $\dfrac{6.6 \times 1.2}{4.4 - 2.75}$

$$= \underline{\underline{4.8}} \quad \text{(A2)}$$

A group of students take a test.
The group consists of 12 boys and 8 girls.
The mean mark for the boys is 18
The mean mark for the girls is 16.5

Calculate the mean mark for the whole group.

$\rightarrow$ TOTAL $= 12 \times 18$
$= 216$

$\rightarrow$ TOTAL $= 8 \times 16.5$
$= 132$

TOTAL FOR BOTH BOYS AND GIRLS

$216 + 132 = 348$

MEAN MARK $= \dfrac{348}{20}$

$= 17.4$

.................17.4.................

Bhavik left his home at 12 00 to cycle to Sam's house.
On the way Bhavik stopped for a rest, and then continued his journey.
The distance-time graph shows his journey.
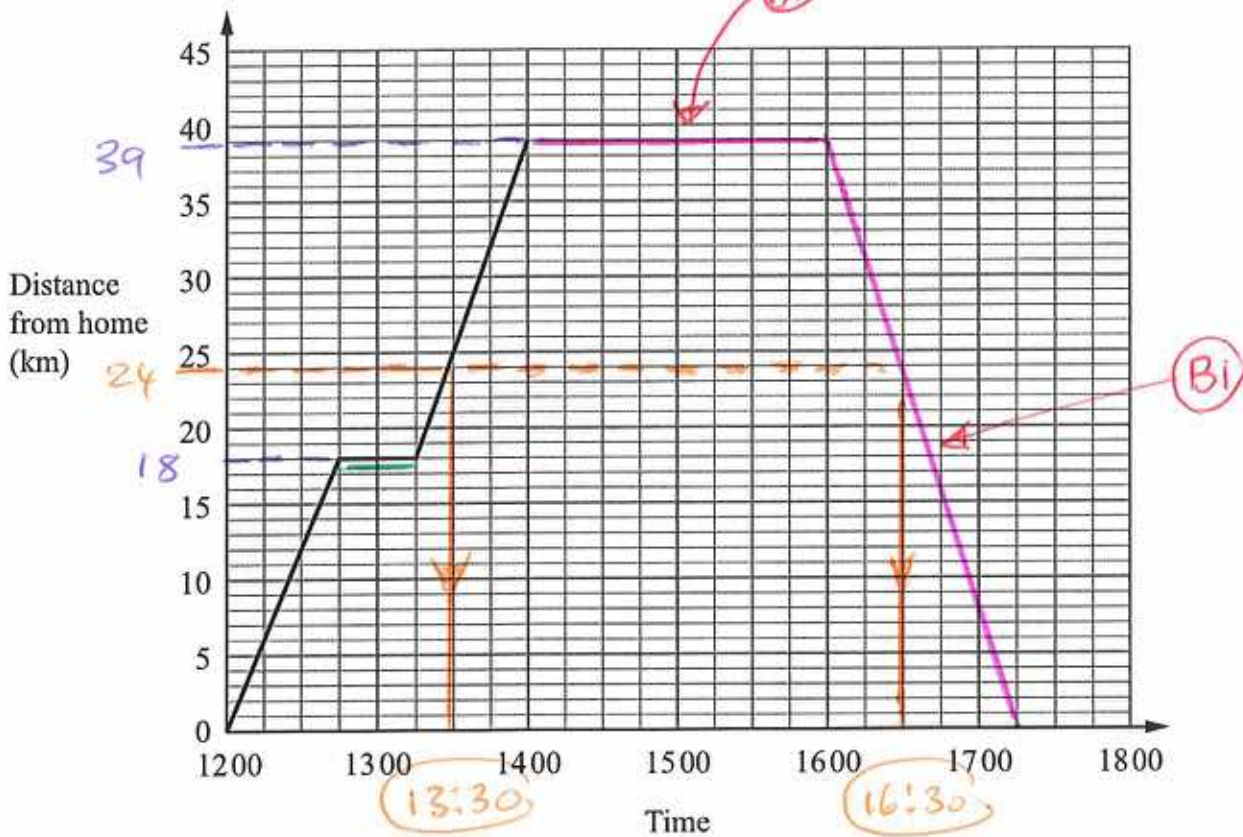
(a) (i) For how many minutes did Bhavik stop for a rest?

30 minutes

(ii) After his rest, how many more kilometres did Bhavik cycle to Sam's house?

39 − 18

21 km

(2)

(b) Bhavik stayed at Sam's house for 2 hours.
He then cycled back to his home.
He arrived home at 17 15.

Show all this information on the graph.

(2)

(c) Write down the times at which Bhavik was 24 kilometres from his home.

13:30 AND 16:30

(d) Work out the average speed, in kilometres per hour, of Bhavik's journey from Sam's house back to his home.

Give your answer correct to 1 decimal place.

SPEED = $\dfrac{DISTANCE}{TIME}$

$\dfrac{39}{1.25}$ } (M1) [DIVISION]

(B1)

1 HOUR 15 MINS !

(A1)

31.2 km/h

(3)

$x = 1$

(A1) 90° ROTATION

(A1) CORRECT POSITION
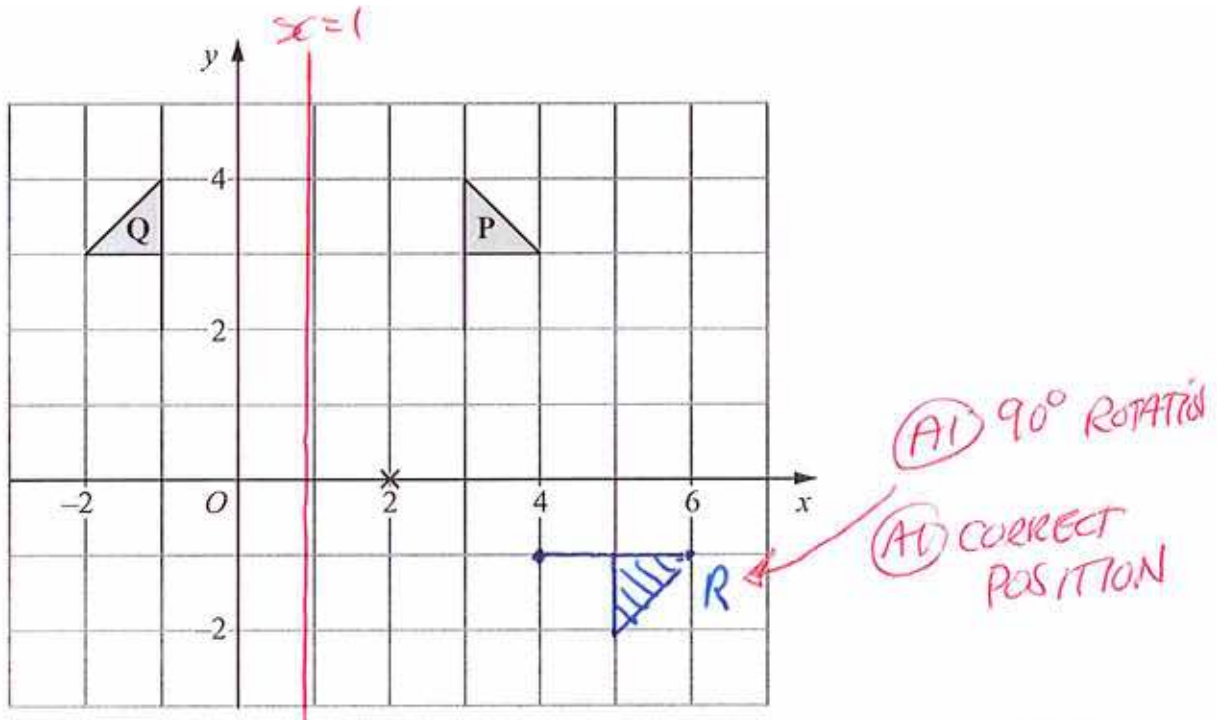
(a) Describe fully the single transformation that maps shape **P** onto shape **Q**.

REFLECTION , MIRROR LINE IS $x = 1$ (A1)

(A1)

(2)

(b) On the grid, rotate shape **P** 90° clockwise about the point (2, 0).
Label the new shape **R**.

(2)

(a) Show that $\frac{4}{5} \div \frac{7}{15} = 1\frac{5}{7}$

$$\frac{4}{5} \times \frac{15}{7} = \frac{60}{35} \quad \text{(B1)} \; [\text{EITHER}]$$
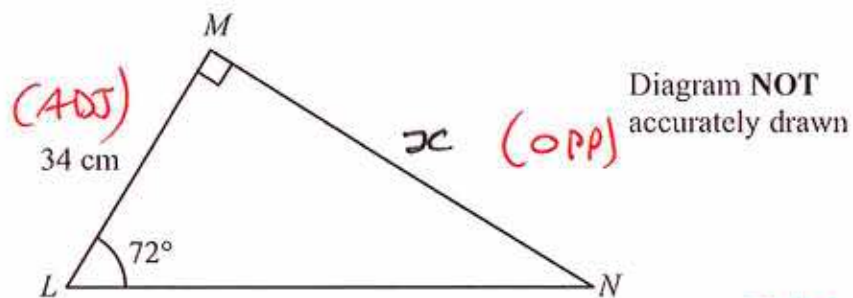
$$\text{(B1)} \quad = 1\frac{2}{7} \quad = 1\frac{5}{7}$$

(1)

(b) Show that $5\frac{1}{4} - 1\frac{2}{3} = 3\frac{7}{12}$

$$\frac{21}{4} - \frac{5}{3} = \frac{63}{12} - \frac{20}{12} \quad \text{(m1)} \; \left[\begin{array}{l}\text{COMMON} \\ \text{DENOMINATOR}\end{array}\right]$$

$$= \frac{43}{12} \quad \text{(m1)} \; [\text{SINGLE FRACTION}]$$

(4)

$$\text{(m1)} \qquad = 3\frac{7}{12}$$

$$\left[\begin{array}{l}\text{IMPROPER} \\ \text{FRACTIONS}\end{array}\right]$$

(ADJ)

34 cm

M

72°

L

x (OPP)

N

Diagram **NOT** accurately drawn

SOH CAH TOA

Calculate the length of *MN*.
Give your answer correct to 3 significant figures.

$$TAN\ 72° = \frac{OPP}{ADJ}$$

$$TAN\ 72° = \frac{x}{34}\ \text{(M1)}$$

$$x = 34\ TAN\ 72°\ \text{(M1)}$$

$$= 104.64\ldots$$

_____105_____ (A1) cm

Showing clear algebraic working, solve the simultaneous equations

$$3a + 2b = 1 \quad \text{——} \quad ①$$
$$a + 2b = 5 \quad \text{——} \quad ②$$

SUBTRACT $\quad 2a \quad = -4 \quad$ (m1)

$$a = -\frac{4}{2}$$

$$= -2$$

SUBSTITUTE $a = -2$ INTO ①

$$3 \times (-2) + 2b = 1$$
$$-6 + 2b = 1$$
$$2b = 7$$
$$b = 3.5$$

$a =$ -2 (A1)

$b =$ 3.5 (A1)

Express 300 as a product of its prime factors.
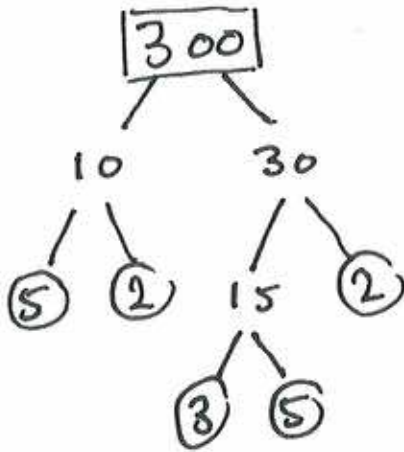
(M1) [OR EQUIVALENT METHOD]

$$300 = 2 \times 2 \times 3 \times 5 \times 5 \quad \text{(A1)}$$

$$= 2^2 \times 3 \times 5^2 \quad \text{(A1)}$$

The table shows information about the snowfall in Ottawa in January one year.

Snowfall (s cm)	Number of days (f)	MID-VALUE (x)	$x \times f$
$0 \leqslant s < 2$	19	1	19
$2 \leqslant s < 4$	8	3	24
$4 \leqslant s < 6$	3	5	15
$6 \leqslant s < 8$	0	7	0
$8 \leqslant s < 10$	1	9	9

(M1)

Work out an estimate for the total snowfall in January.

(B1)

$$19 + 24 + 15 + 0 + 9 = \underline{67} \quad \text{(A1)}$$

(a) Expand and simplify

(i) $5(2x + 1) - 3(3x - 1)$

$10x + 5 \quad -9x + 3$ (m1)

$x + 8$ (A1)

(ii) $(y + 5)(y - 7)$

F   O   i   L

$y^2 \quad -7x \quad +5x \quad -35$ (m1)

$y^2 - 2x - 35$ (A1)

(4)

(b) Make r the subject of the formula $V = \pi r^2 h$ where r is positive.

$\pi r^2 h = V$

$\Rightarrow \quad r^2 = \dfrac{V}{\pi h}$ (m1)

$r = \sqrt{\dfrac{V}{\pi h}}$ (A1)

(2)

The mass of the Space Shuttle is 7.8×10^4 kilograms.

(a) Write 7.8×10^4 as an ordinary number.

<u>78 000</u> Ⓑ①

(1)

The Space Shuttle docks with the International Space Station.
The mass of the International Space Station is 4.62×10^5 kilograms.

(b) Calculate the total mass of the Space Shuttle and the International Space Station.
Give your answer in standard form.

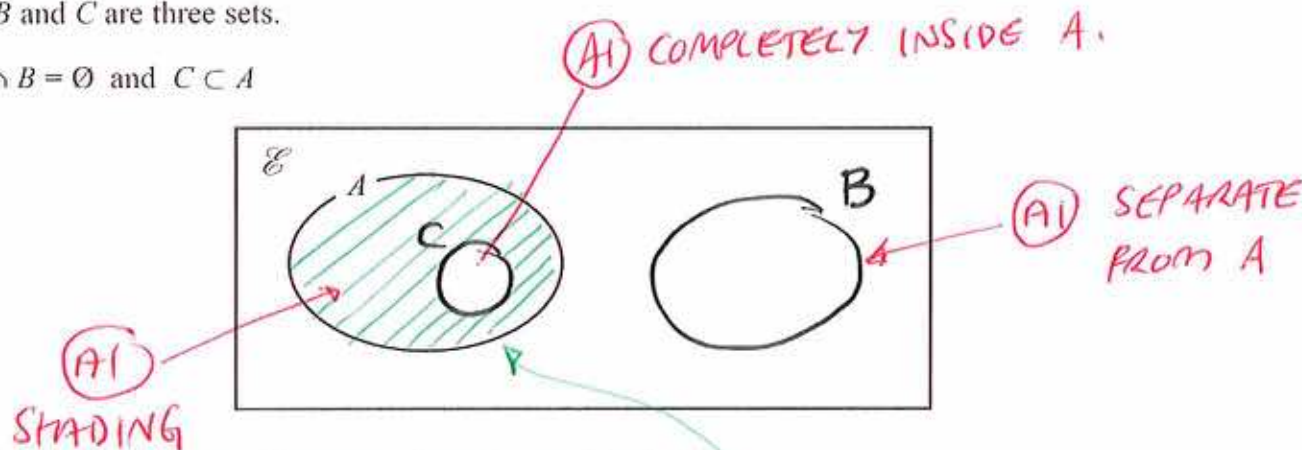$$7.8 \times 10^4 + 4.62 \times 10^5 = 540\,000$$

Ⓜ①

$$\underline{5.4 \times 10^5} \;Ⓐ① \text{ kg}$$

(2)

A, B and C are three sets.

$A \cap B = \emptyset$ and $C \subset A$

(A1) COMPLETELY INSIDE A.

(A1) SEPARATE FROM A

(A1) SHADING

(a) Complete the Venn diagram to show the sets B and C

(2)

(b) On the Venn diagram, shade the region that represents $A \cap C'$

(1)

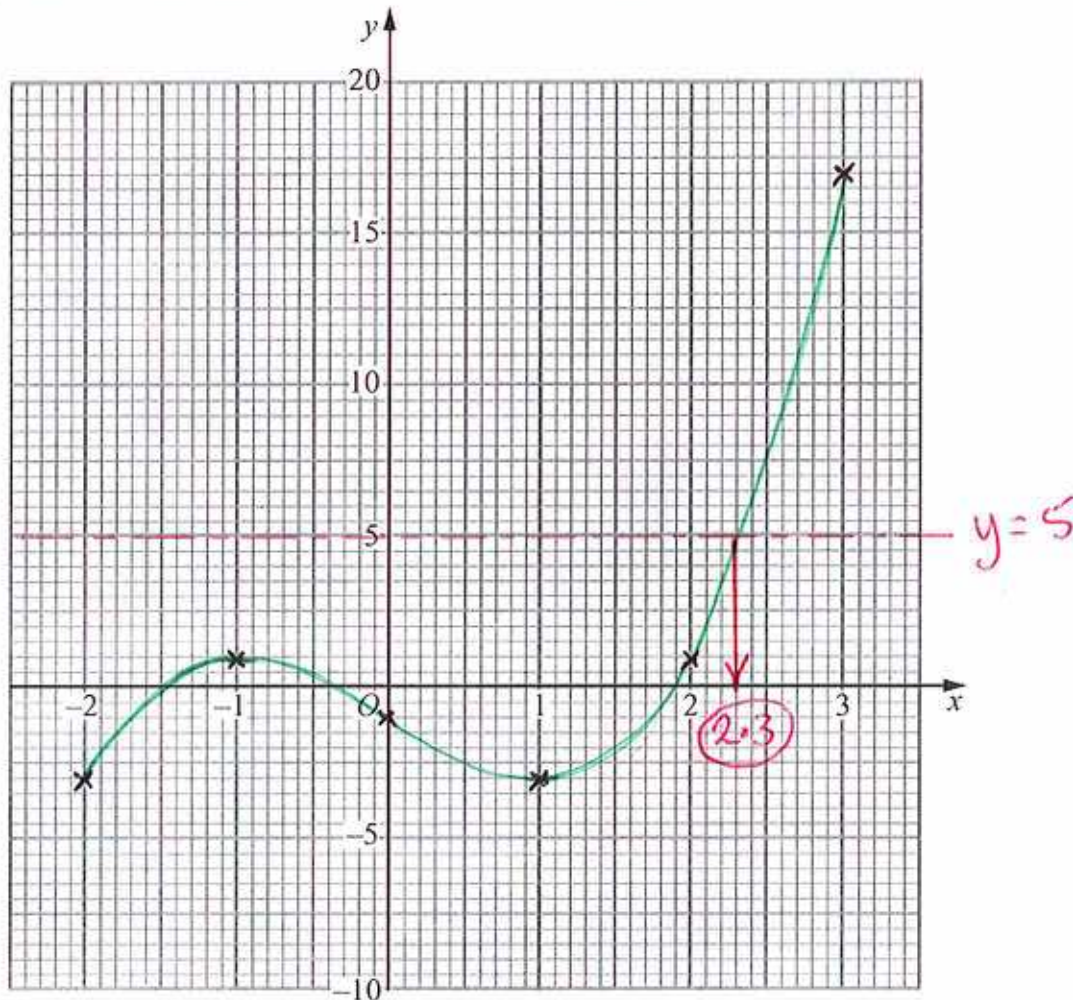(a) Complete the table of values for $y = x^3 - 3x - 1$

$$y = (-2)^3 - 3 \times (-2) - 1 \quad \text{ETC}$$

x	-2	-1	0	1	2	3
y	-3	1	-1	-3	1	7

(2)

(b) On the grid, draw the graph of $y = x^3 - 3x - 1$ for $-2 \leqslant x \leqslant 3$

$y = 5$

2.3

(2)

(c) By drawing a suitable straight line on the grid, find an estimate for the solution of
the equation $x^3 - 3x - 6 = 0$
Give your answer correct to 1 decimal place.

$$x^3 - 3x - 6 = 0$$

$$\Rightarrow \underline{x^3 - 3x - 1} = \underset{\uparrow}{5}$$

CURVE (ALREADY DRAWN)

STRAIGHT LINE (NEED TO DRAW)

$\underline{x = 2.3}$

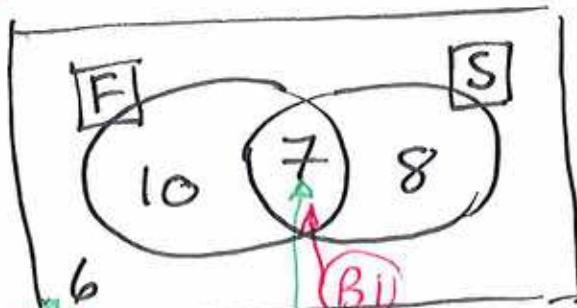There are (31) students in a class.
The only languages available for the class to study are French and Spanish.
17 students study French. } TOTAL 32
15 students study Spanish.
6 students study neither French nor Spanish.

(1ST)

Using a Venn diagram, or otherwise, work out how many students study only one language.

(2ND)

31 - 6 = 25 LEFT

32 - 25 = 7 (OVERLAP)

F: 10, overlap 7, S: 8, outside 6

(B1) (B1)
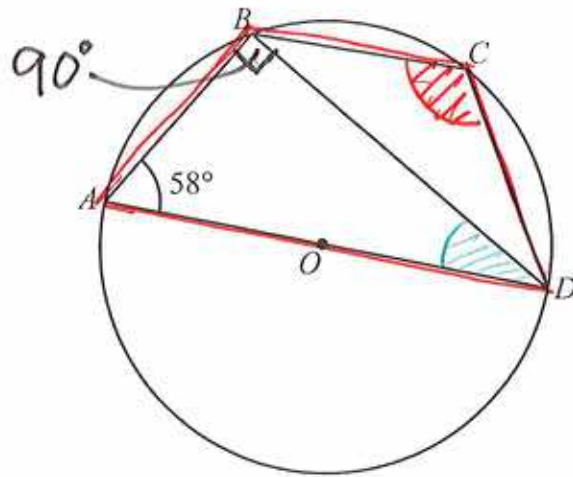
(A1) F=17 AND S=15   10 + 8 = 18 (A1)

Diagram **NOT** accurately drawn

A, B, C and D are four points on a circle, centre O.
AD is a diameter of the circle.
Angle $BAD = 58°$

(a) Calculate the size of angle ADB.

$$180 - (90 + 58)$$

BI

AI

$$32°$$

(2)

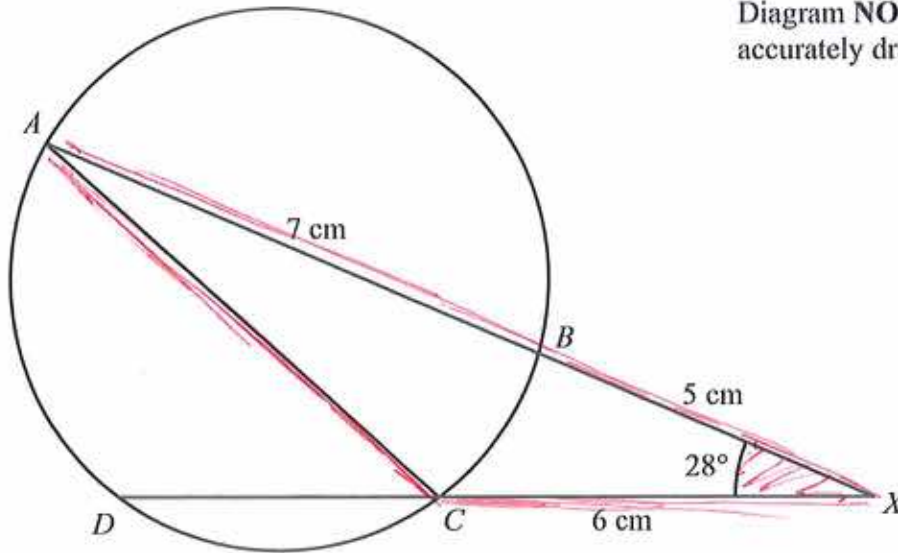(b) (i) Calculate the size of angle BCD.

$$180 - 58$$

AI

$$122°$$

(ii) Give a reason for your answer.

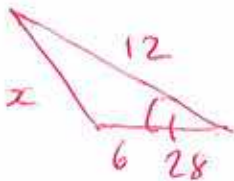OPPOSITE ANGLES IN A CYCLIC QUADRILATERAL ADD TO 180° AI

(2)

Diagram **NOT** accurately drawn

A

7 cm

B

5 cm

28°

D   *C*   6 cm   *X*

A, *B*, *C* and *D* are four points on a circle.
ABX and *DCX* are straight lines.
AB = 7 cm, *BX* = 5 cm and *CX* = 6 cm.
Angle *BXC* = 28°

COSINE RULE

(a) Calculate the length of *AC*.
    Give your answer correct to 3 significant figures.

12

x

6 28

$$x^2 = 6^2 + 12^2 - 2 \times 6 \times 12 \cos 28 \quad \text{(M1)}$$

$$= 52.85\ldots$$
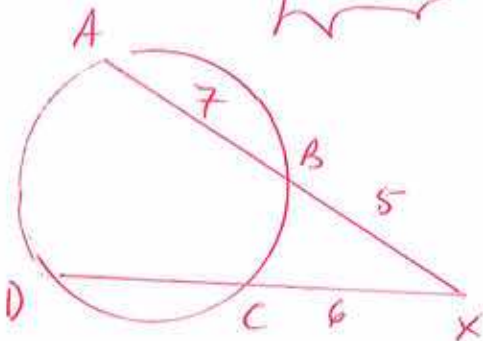
$$x = \sqrt{52.85\ldots} \quad \text{(M1)}$$

$$= 72701.\ldots$$

$$\underline{7.27} \quad \text{(A1)} \quad \text{cm}$$

(3)

(b) Calculate the length of *DC*.

CHORD PROPERTIES

A

7

B

5

D   *C* 6 *X*

$$DX \cdot CX = AX \cdot BX$$

$$DX \times 6 = 12 \times 5 \quad \text{(M1)}$$

$$DX = \frac{12 \times 5}{6}$$

$$= 10 \quad \text{(A1)}$$

$$\Rightarrow DC = 10 - 6$$

$$= \underline{4}$$

$$\underline{4} \quad \text{(A1)} \quad \text{cm}$$

(3)

The histogram shows information about the times, t minutes, patients spent at a doctors' surgery on one day.
No patient spent more than 40 minutes at the surgery.

Frequency density

5×35

5×8

5×19

10×10

15×6

Time (t minutes)
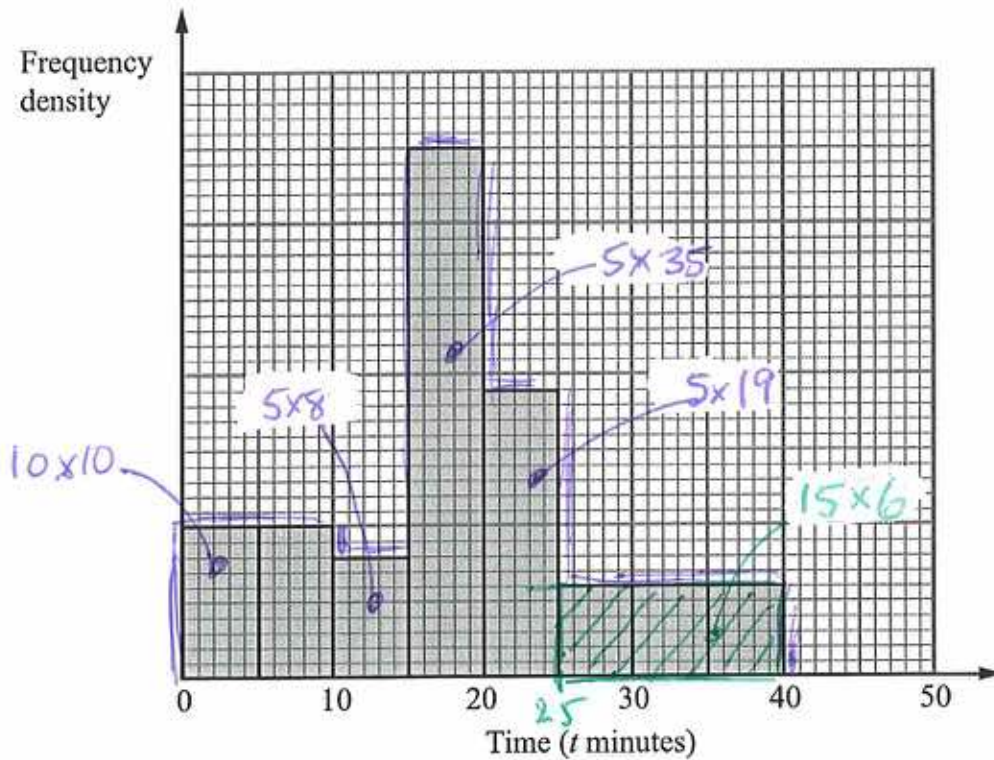
(a) Calculate the percentage of the patients who spent between 25 and 40 minutes at the surgery.

25   40

AREA = 15 × 6
     = 90 (M1)

TOTAL
AREA = 100 + 40 + 175 + 95 + 90
     = 500 (M1)

$\frac{90}{500} \times 100$

↓

18 (A1)   %
(3)

(b) 16 patients spent between 10 and 15 minutes at the surgery.

Calculate the total number of patients at the surgery that day.

AREA BETWEEN 10 AND 15 MINUTES = 40

∴ AREA OF 40 IS 16 PATIENTS

∴ AREA OF 500 IS $\frac{16}{40} \times 500 = 200$ (A1)

(M1)

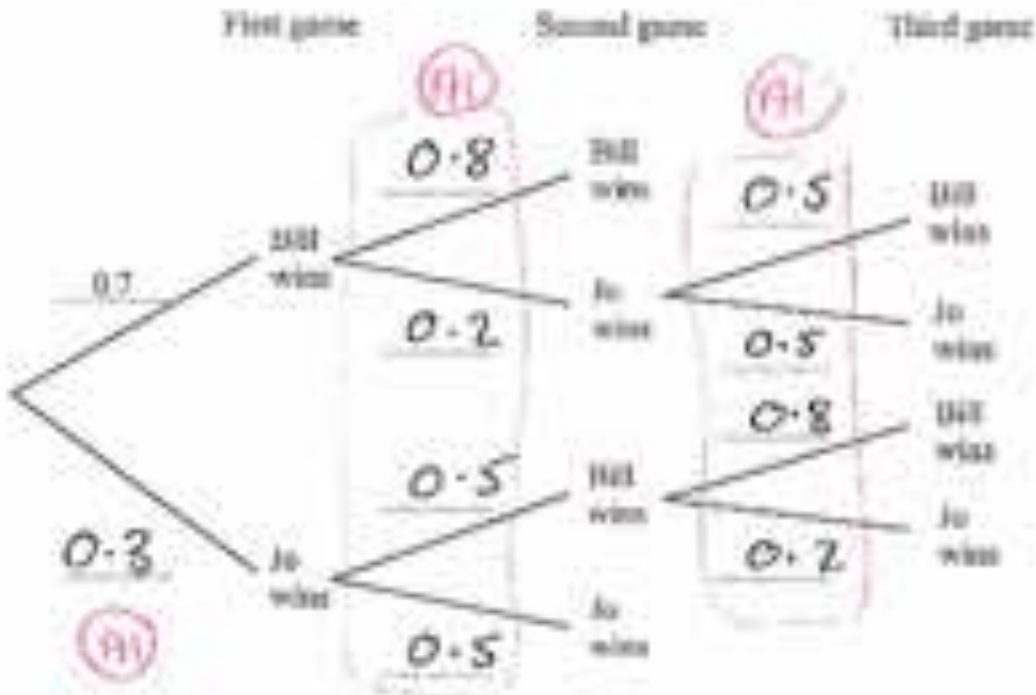Bill and Jo play some games of table tennis.
The probability that Bill wins the first game is 0.7
When Bill wins a game, the probability that he wins the next game is 0.8
When Jo wins a game, the probability that she wins the next game is 0.5

The first person to win two games wins the match.

(a) Complete the probability tree diagram.

(b) Calculate the probability that Bill wins the match.

$$P(BB) = 0.7 \times 0.8$$
$$P(BJB) = 0.7 \times 0.2 \times 0.5$$
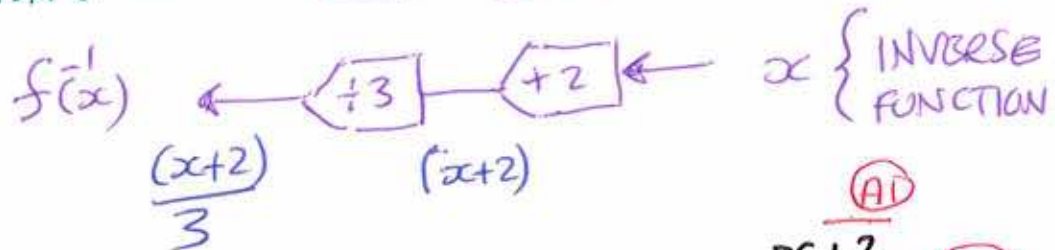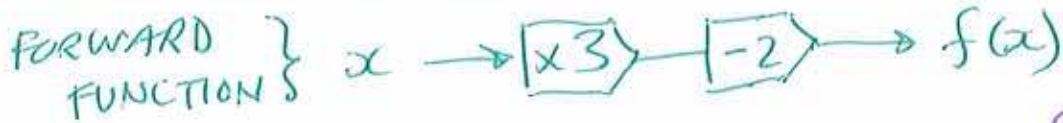$$P(JBB) = 0.3 \times 0.5 \times 0.8$$

TOTAL = 0.75

[THREE POSSIBILITIES]

[MULTIPLYING PROBABILITIES]

$f(x) = 3x - 2$

$g(x) = \dfrac{10}{x + 2}$

(a) Express the inverse function f^{-1} in the form $f^{-1}(x) = ...$

FORWARD FUNCTION $\}$ $x \longrightarrow \boxed{\times 3} \longrightarrow \boxed{-2} \longrightarrow f(x)$

$f^{-1}(x) \longleftarrow \boxed{\div 3} \longleftarrow \boxed{+2} \longleftarrow x \{$ INVERSE FUNCTION

$\dfrac{(x+2)}{3}$ $(x+2)$

$f^{-1}(x) = \underline{\dfrac{x+2}{3}}$ ⒶⒷⒾ

(2)

(b) Find gf(x)
    Simplify your answer.

$\dfrac{10}{(3x-2)+2}$ Ⓜ $= \dfrac{10}{3x}$ ⒶⒾ

Show that $(6-\sqrt{8})^2 = 44 - 24\sqrt{2}$

Show each stage of your working clearly.

$(6-\sqrt{8})(6-\sqrt{8})$

$36 - 6\sqrt{8} - 6\sqrt{8} + 8 \quad = 44 - 12\sqrt{8}$ (B1)

(m1)

$= 44 - 12\sqrt{4 \times 2}$ } (B1)

$= 44 - 12 \times 2\sqrt{2}$ } (EITHER)

$= \underline{44 - 24\sqrt{2}}$

Solve $\dfrac{5}{(x+2)} + \dfrac{9}{(x-2)} = 2$

Show clear algebraic working.

$$\frac{5(x-2) + 9(x+2)}{(x+2)(x-2)} = 2 \quad \textcircled{m1}$$

$$\Rightarrow \frac{5x - 10 + 9x + 18}{(x+2)(x-2)} = 2$$

$$\Rightarrow \frac{14x + 8}{(x+2)(x-2)} = 2 \quad \textcircled{B1}$$

$$14x + 8 = 2(x+2)(x-2) \quad \textcircled{B1}$$
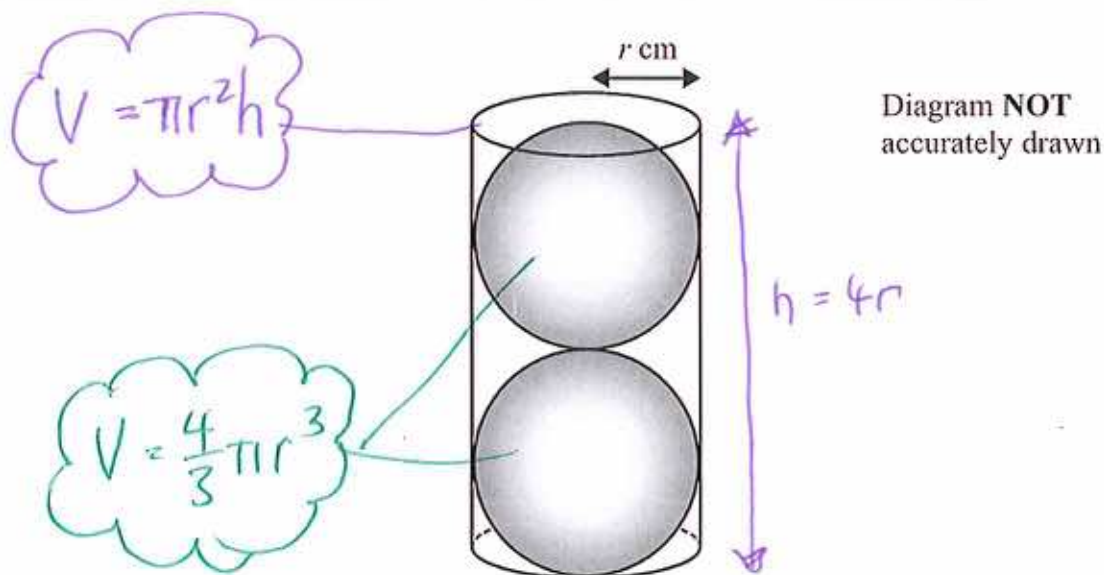
$$7x + 4 = (x+2)(x-2)$$

$$7x + 4 = x^2 - 4$$

$$\Rightarrow x^2 - 7x - 8 = 0 \quad \textcircled{B1} \qquad\qquad \underline{x = -1, \quad x = 8} \quad \textcircled{A1}$$

$$(x+1)(x-8) = 0$$

$x + 1 = 0 \qquad\qquad x - 8 = 0$

$x = \underline{-1} \qquad\qquad x = \underline{8}$

$$V = \pi r^2 h$$

r cm

Diagram **NOT**
accurately drawn

$$V = \frac{4}{3} \pi r^3$$

$h = 4r$

Two solid spheres, each of radius r cm, fit exactly inside a hollow cylinder.
The radius of the cylinder is r cm.
The height of the cylinder is equal to $4r$ cm.

The volume of the space inside the cylinder, not occupied by the spheres, is $\dfrac{125}{6}\pi$ cm^3

Calculate the value of r.

Show your working clearly.

VOL OF CYLINDER — 2 × VOL OR = $\dfrac{125\pi}{6}$

(B1)   SPHERE

$$\pi r^2 \times 4r \quad - \quad 2 \times \frac{4}{3}\pi r^3 \quad = \quad \frac{125\pi}{6}$$

h   (M1)

(M1) [ANY CORRECT EQUATION]

$$4r^3 - \frac{8}{3}r^3 = \frac{125}{6}$$

$$\frac{4}{3}r^3 = \frac{125}{6}$$

$$r^3 = \frac{125}{6} \times \frac{3}{4} \quad (M1)$$

(A1)

$$r = \sqrt[3]{\frac{375}{24}}$$

$r = \underline{2 \cdot 5}$