Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE

Centre Number						Candidate Number			

Wednesday 15 January 2020

Morning (Time: 2 hours 30 minutes) | Paper Reference **4MB1/02**

Mathematics B
Paper 2

You must have: Ruler graduated in centimetres and millimetres, protractor, 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.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Calculators may be used**.

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.
- Without sufficient working, correct answers may be awarded no marks.

Turn over ▶

Pearson

Answer ALL TWELVE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 $A = 2^3 \times 3^2 \times 5 \times 7$

$B = 2 \times 3^4 \times 5^2 \times 11$

(a) Find the highest common factor (HCF) of A and B.

(1)

(b) Find the lowest common multiple (LCM) of A and B.

(1)

(c) Find the least number that A must be multiplied by to give a square number.

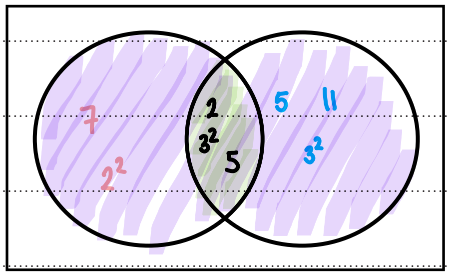
(1)

$C = 3 \times 10^{205} \times 5 \times 10^{205}$

(d) Work out the value of C, giving your answer as a number in standard form.

(2)

For this question, first draw a Venn diagram.



(a) HCF (A and B) $= 2 \times 3^2 \times 5$

$= 90$

(c) LCM (A and B) $= 7 \times 2^2 \times 2 \times 3^2 \times 5 \times 5 \times 11 \times 3^2$

$= 1247\ 400$

(d) $A = 2520$

$2520 \times (2 \times 5 \times 7) = 176400$

$\sqrt{176400} = 420$

$\therefore 2 \times 5 \times 7 = 70$

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Question 1 continued

(e) $C = 3 \times 10^{205} \times 5 \times 10^{205}$

$= (3 \times 5) \times (10^{205} \times 10^{205})$

$= 15 \times 10^{205+205}$

$= 15 \times 10^{410}$

$= 1.5 \times 10^{411}$

Rules of indices:

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

$x^a \div x^b = x^{a-b}$

$(x^a)^b = x^{ab}$

(Total for Question 1 is 5 marks)

2 The points with coordinates (2, 1), (5, 1), (3, 3) and (6, 3) are the vertices of parallelogram A.

(a) On the grid, draw and label parallelogram A.

(1)

Parallelogram A is transformed to parallelogram B under the translation $\begin{pmatrix} 2 \\ -5 \end{pmatrix}$

(b) On the grid, draw and label parallelogram B.

(2)

Parallelogram B is transformed to parallelogram C by a reflection in the line with equation $x = 2$

(c) On the grid, draw and label parallelogram C.

(2)

Parallelogram C is transformed to parallelogram D by a rotation through 90° anticlockwise about the point with coordinates (–5, 0)

(d) On the grid, draw and label parallelogram D.

(2)

(a) Plot and Draw

(b) Move A two blocks right and 5 blocks down.

(c) Draw $x=2$ and reflect.

(d) Using tracing paper and label centre of rotation.

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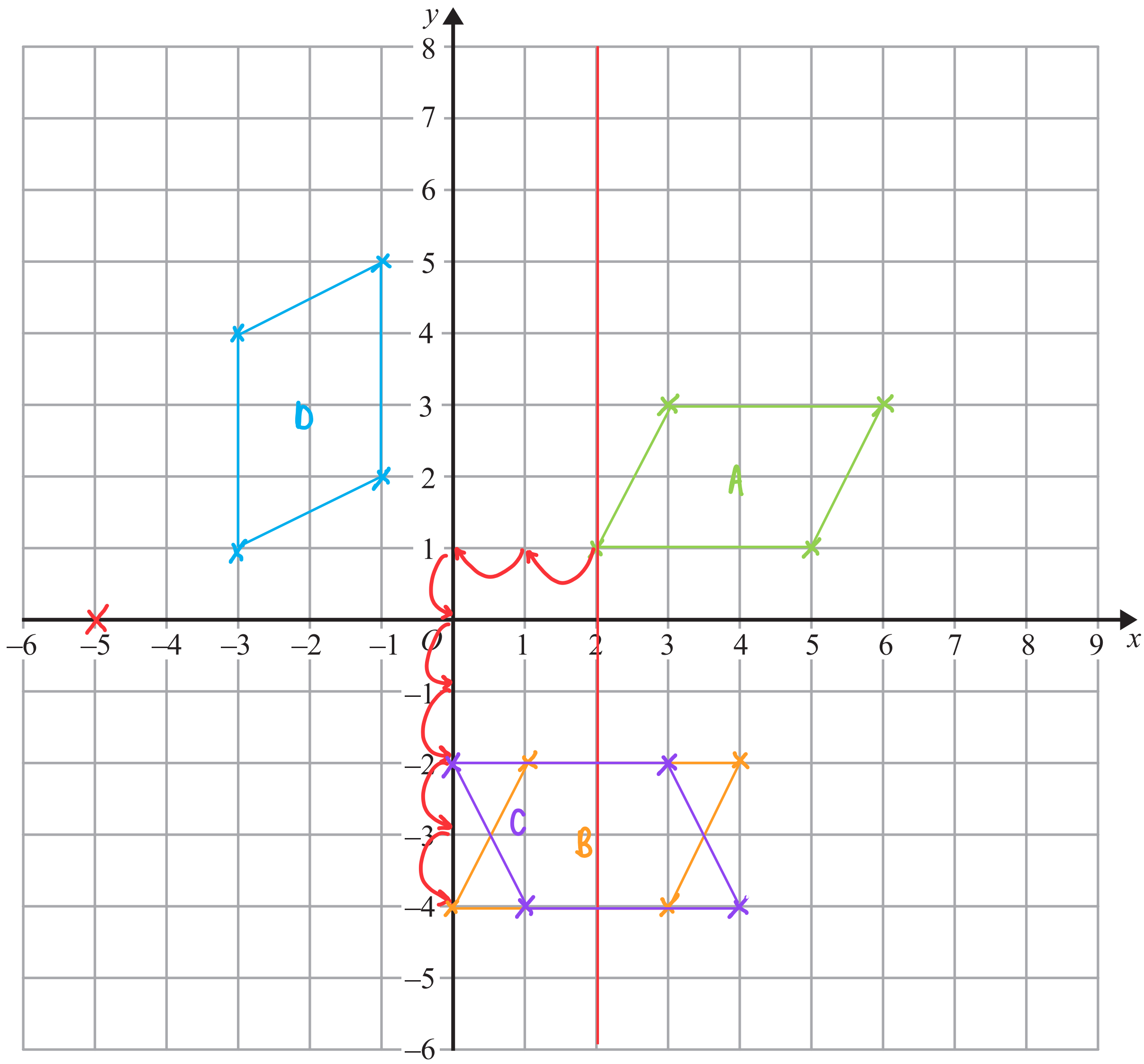
Question 2 continued

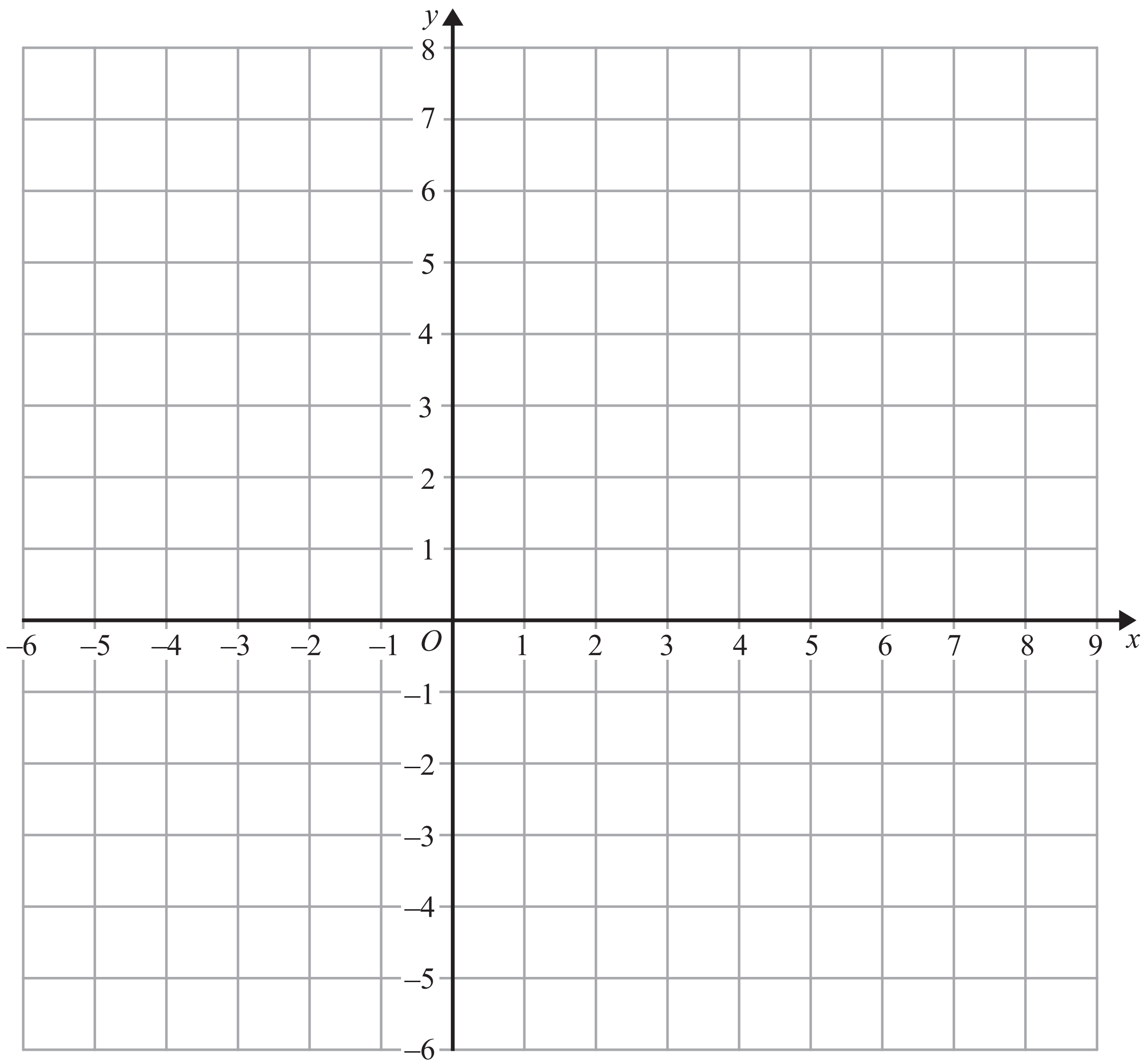


Turn over for a spare grid if you need to redraw your parallelograms.

Question 2 continued

Question 2 continued

Only use this grid if you need to redraw your parallelograms.



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(Total for Question 2 is 7 marks)

3

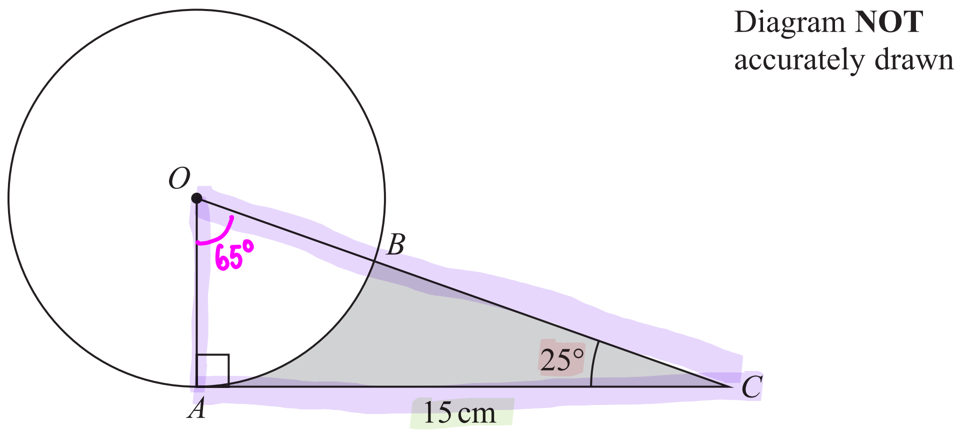

Figure 1

In Figure 1, A and B are two points on a circle with centre O. The line AC is the tangent to the circle at A and OBC is a straight line.

$AC = 15\text{ cm}$ and $\angle OCA = 25°$

(a) Calculate the area, in cm^2 to 3 significant figures, of the circle.

(3)

The region inside triangle OAC but outside the circle is shown shaded in Figure 1

(b) Calculate the area, in cm^2 to 3 significant figures, of this shaded region.

(4)

(a) You can find the radius of the circle using trigonometry.

You have an angle and the adjacent and want to find the opposite so use tan.

$$\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$$

$$\tan 25 = \frac{AO}{15}$$

$$\tan 25 \times 15 = AO$$

$$6.99\ldots = AO$$

Area of a circle $= \pi r^2$

$$\text{Area} = \pi \times (6.99\ldots)^2$$

$$= 153.70\ldots$$

$$\approx 154\text{ cm}^2$$

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Question 3 continued

(b) Find the area of the triangle

Area of a triangle $= \frac{1}{2} \times$ base $\times$ height

Area $= \frac{1}{2} \times 15 \times 6.99...$

$= 52.45...$

Find area of sector:

$153.701... \times \frac{65}{360} = 27.751...$

Area of shaded region = Area of triangle − Area of sector

Area of shaded region $= 52.45... - 27.751...$

$= 24.707..$

$\approx 24.7 \text{ cm}^2$

(Total for Question 3 is 7 marks)

4 In a race, Akaash ran a distance of $(8x^2 - 105)$ metres in $(6x + 1)$ seconds.

His average speed for the race was x m/s.

(a) Show that x satisfies the equation $2x^2 - x - 105 = 0$

(2)

(b) Hence calculate the distance, in metres, that Akaash ran in the race.
Show clear algebraic working.

(4)

(a) Speed = distance ÷ time

$x = \dfrac{8x^2 - 105}{6x + 1}$

$(6x+1)x = 8x^2 - 105$

$6x^2 + x = 8x^2 - 105$

$x = 2x^2 - 105$

$0 = 2x^2 - x - 105$

(b) ① Solve $2x^2 - x - 105 = 0$ for x.

$2x^2 - x - 105 = 0$

$2 \times -105 = -210$

$\dfrac{(2x - 15)(\cancel{2}x + \cancel{14}\,7)}{\cancel{2}} = 0$

$(2x - 15)(x + 7) = 0$

$2x - 15 = 0$ $\qquad x + 7 = 0$

$2x = 15$ $\qquad x = -7$ → Reject $x = -7$ since substituting into $6x+1$ would give a negative value for time.

$x = \dfrac{15}{2}$

② Substitute for value of distance.

$x = \dfrac{15}{2}$

$8\left(\dfrac{15}{2}\right)^2 - 105 = 345\text{m}$

Question 4 continued

(Total for Question 4 is 6 marks)

Turn over

5 When Joe goes to school in winter, the probability that he wears a coat is $\frac{5}{8}$

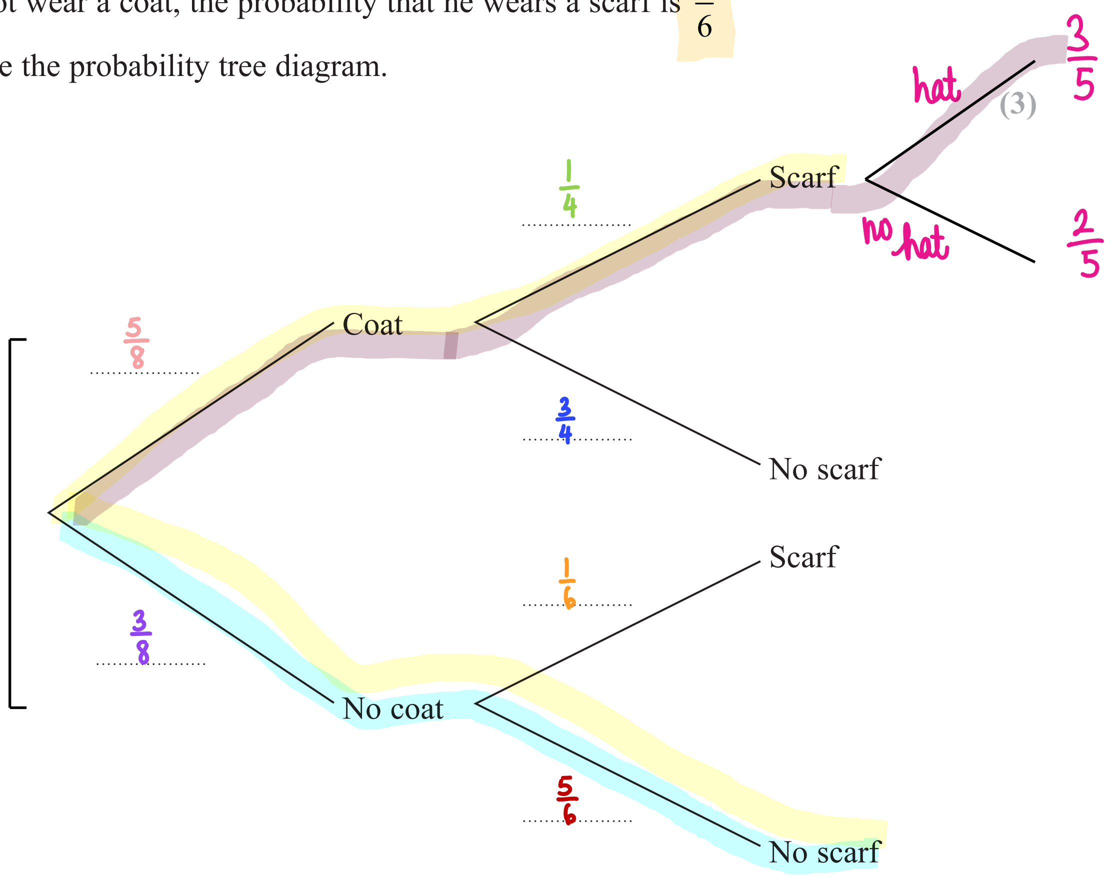
If he wears a coat, the probability that he wears a scarf is $\frac{1}{4}$

If he does not wear a coat, the probability that he wears a scarf is $\frac{1}{6}$

(a) Complete the probability tree diagram.

(3)

Connected branches must add to 1.



On a day Joe goes to school in winter, calculate the probability that

(b) he is not wearing a coat and is not wearing a scarf,

(2)

(c) he is wearing a coat or he is wearing a scarf but he is not wearing both a coat and a scarf.

(2)

On a day Joe goes to school in winter, if he is wearing a coat and a scarf then the probability that he is also wearing a hat is $\frac{3}{5}$

(d) Calculate the probability, that on a day Joe goes to school in winter, he is not wearing all three of a coat, a scarf and a hat.

(3)

(b) You need to multiply across branches.

$\frac{3}{8} \times \frac{5}{6} = \frac{5}{16}$

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Question 5 continued

(c) You can either add P(Coat, No Scarf), P(Scarf, No Coat) or subtract P(Coat, Scarf) and P(No Coat, No Scarf) from 1.

$1 - P(\text{Coat, Scarf}) - P(\text{No Coat, No Scarf}) = 1 - \left(\frac{5}{8} \times \frac{1}{4}\right) - \frac{5}{16}$

$= 1 - \frac{15}{32}$

$= \frac{17}{32}$

(d) You can subtract P(Coat, Scarf, Hat) from 1.

$1 - P(\text{Coat, Scarf, Hat}) = 1 - \left(\frac{5}{8} \times \frac{1}{4} \times \frac{3}{5}\right)$

$= 1 - \frac{3}{32}$

$= \frac{29}{32}$

(Total for Question 5 is 10 marks)

6 f and g are two functions such that

$$\mathrm{f}: x \mapsto x^2 + x - 6 \qquad \text{where } x \geqslant -\frac{1}{2}$$

$$\mathrm{g}: x \mapsto \frac{2x - 24}{3 - 2x}$$

(a) State the value of x that must be excluded from any domain of g
(1)

(b) Find the value of a and the value of b such that

$$\mathrm{f}(x) = (x + a)^2 + b$$
(2)

(c) Hence write down the range of f
(1)

(d) Find the value of c for which $\mathrm{g}^{-1}(0) = c$
(2)

Given that $\mathrm{f}(x) = \mathrm{g}(x)$

(e) show that $2x^3 - x^2 - 13x - 6 = 0$

Show clear algebraic working.
(3)

(f) Use the factor theorem to show that $(2x + 1)$ is a factor of $2x^3 - x^2 - 13x - 6$
(2)

The curve with equation $y = \mathrm{f}(x)$ intersects the curve with equation $y = \mathrm{g}(x)$ at the point A with coordinates (p, q), where $p > -\frac{1}{2}$

(g) Find the coordinates of A.
(4)

(a) Any value of x that causes the denominator to be 0 must be excluded since you cannot divide by 0.

$$3 - 2x = 0$$
$$\xrightarrow{-3} \quad -2x = -3$$
$$\xrightarrow{\div 2} \quad x = \frac{3}{2}$$

(b) You need to complete the square for f(x).

$$x^2 + x - 6 = \left(x + \frac{1}{2}\right)^2 - 6 - \frac{1}{4}$$
$$= \left(x + \frac{1}{2}\right)^2 - \frac{25}{4}$$

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Question 6 continued

(c) f(x) must always be greater than the y value of the turning point.

$$f(x) \geq -\frac{25}{4}$$

(d) If $g(x) = \frac{2x-24}{3-2x}$

Swap g(x) for x and x for y and rearrange for y.

$$x = \frac{2y-24}{3-2y}$$

$\times 3-2y$

$$3x - 2yx = 2y - 24$$

$-2y$

$$3x - 2yx - 2y = -24$$

$-3x$

$$-2yx - 2y = -24 - 3x$$

Take out factor of y

$$y(-2x-2) = -24-3x$$

$\div -2x-2$

$$y = \frac{-24-3x}{-2x-2}$$

$$y = \frac{24+3x}{2x+2}$$

$$\therefore g^{-1}(x) = \frac{24+3x}{2x+2}$$

$$g(0) = \frac{24+3(0)}{2(0)+2}$$

$$= 12$$

(e)

$$x^2 + x - 6 = \frac{2x-24}{3-2x}$$

$$(3-2x)\,x^2 + x - 6 = 2x - 24$$

$$3x^2 + 3x - 18 - 2x^3 - 2x^2 + 12x = 2x - 24$$

$$-2x^3 + x^2 + 15x - 18 = 2x - 24$$

$$-2x^3 + x^2 + 13x - 18 = -24$$

$$-2x^3 + x^2 + 13x + 6 = 0$$

$$2x^3 - x^2 - 13x - 6 = 0$$

Question 6 continued

(f) $2x+1=0$

$x=-\frac{1}{2}$

$f\left(-\frac{1}{2}\right)=2\left(-\frac{1}{2}\right)^3-\left(-\frac{1}{2}\right)^2-13\left(-\frac{1}{2}\right)-6$

$=\frac{1}{2}-\frac{1}{4}+\frac{13}{2}-6$

$=0$

(g) You should now factorise $2x^3-x^2-13x-6=0$ to find values of x and y or p and q.

$$\begin{array}{r|l} & x^2-x-6 \\ 2x+1 & 2x^3-x^2-13x-6 \\ & -\underline{(2x^3+x^2)} \\ & -2x^2-13x \\ & -\underline{(-2x^2-x)} \\ & -12x-6 \\ & -\underline{(-12x-6)} \\ & 0 \end{array}$$

$x^2-x-6=0$

$(x-3)(x+2)=0$

$x-3=0$ $\quad$ $x+2=0$

$\underline{\underline{x=3}}$ $\quad$ $x=-2$

Since $p>-\frac{1}{2}$, $p=3$

Sub into $f(x)$ for q.

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

$\therefore \underline{\underline{(3,6)}}$

Question 6 continued

(Total for Question 6 is 15 marks)

7

Diagram **NOT** accurately drawn

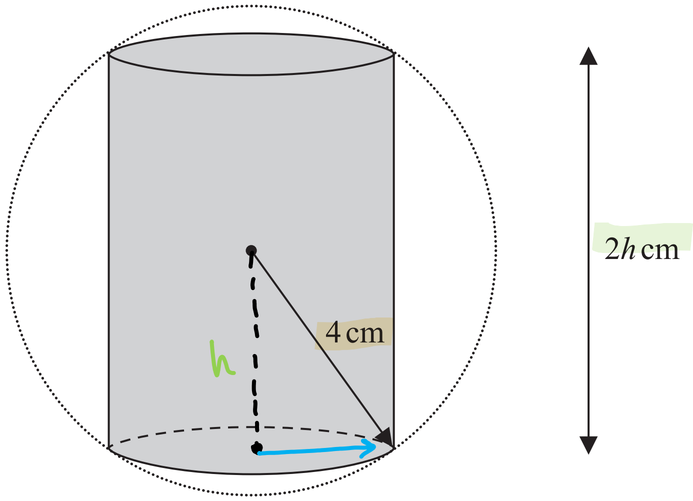


Figure 2

Figure 2 shows a right circular cylinder cut from a solid sphere of radius 4 cm. The height of the cylinder is $2h$ cm.

The volume of the cylinder is V cm^3

(a) Show that $V = 32\pi h - 2\pi h^3$

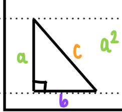
(3)

(b) Using calculus, find the stationary value, to 3 significant figures, of V.
Show your working clearly.

(4)

(a) You can find the radius of the cylinder using Pythagoras but it must be in terms of h.

Pythagoras's theorem:



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

$h^2 + r^2 = 4^2$

$r^2 = 16 - h^2$

$r = \sqrt{16-h^2}$

Volume of cylinder $= \pi r^2 h$

Volume $= \pi \times \left(\sqrt{16-h^2}\right)^2 \times 2h$

$= \pi \times (16-h^2) \times 2h$

$= \pi \times (32h - 2h^3)$

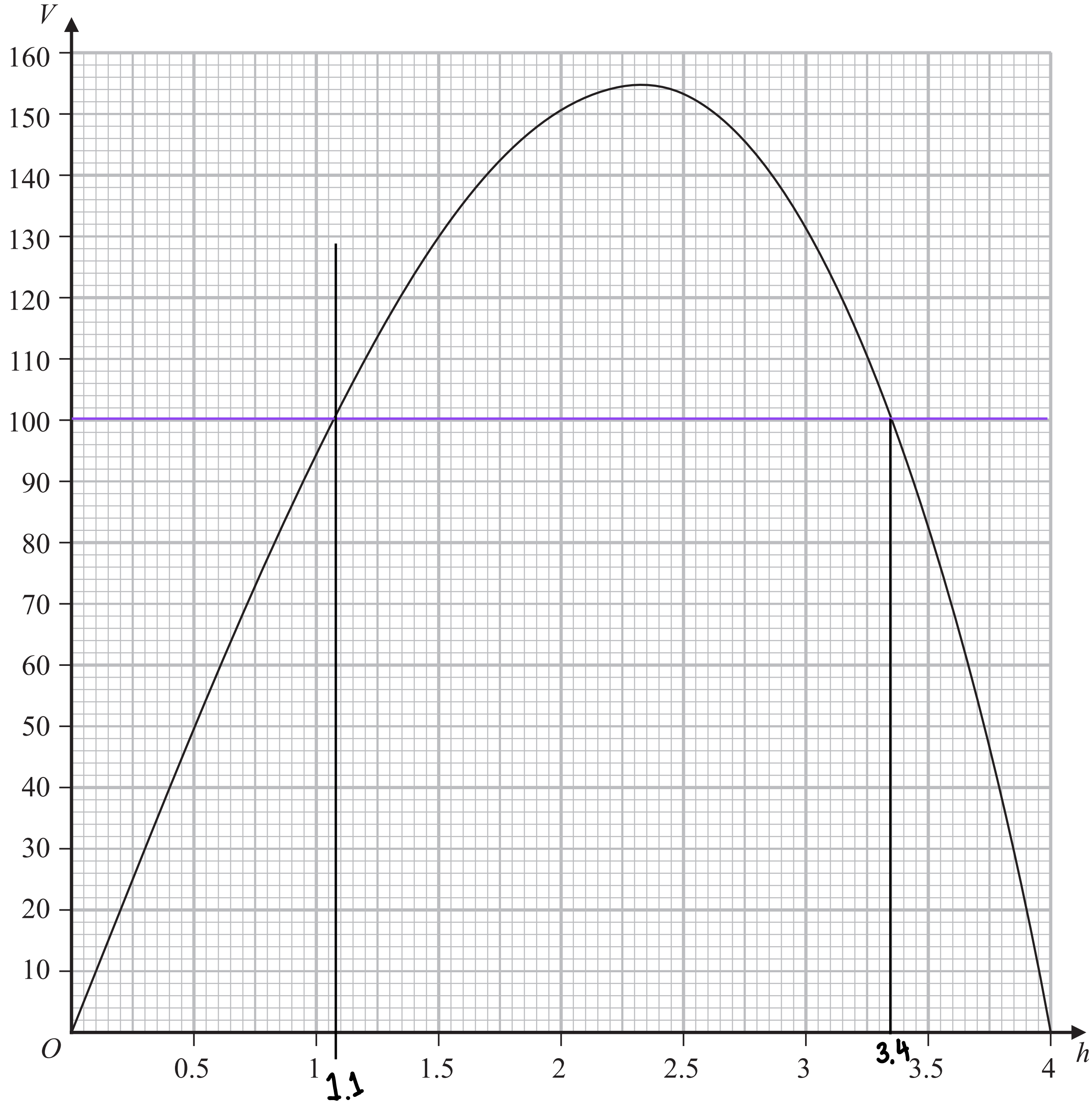
$= 32\pi h - 2\pi h^3$

[Volume of cylinder $= \pi r^2 h$]

P 5 9 7 6 6 A 0 1 8 3 6

Question 7 continued

Part of the curve with equation $V = 32\pi h - 2\pi h^3$ is drawn on the grid.



(c) Find an estimate, to one decimal place, of each of the two values of h for which the volume of the cylinder is $100\,\text{cm}^3$

(2)

$h_1 = 1.1\text{cm}$

$h_2 = 3.4\text{cm}$

Question 7 continued

(b) $V = 32\pi h - 2\pi h^3$

You can differentiate in respect to h and find stationary points.

$V = 32\pi h - 2\pi h^3$

$\frac{dV}{dh} = 32\pi - (3)2\pi h^{3-1}$

$= 32\pi - 6\pi h^2$

$0 = 32\pi - 6\pi h^2$

$32\pi = 6\pi h^3$

$\frac{16}{3} = h^2$

$\pm \frac{4}{\sqrt{3}} = h$

$\therefore h =$

Substitute back into V.

$V = 32\pi\left(\frac{4}{\sqrt{3}}\right) - 2\pi\left(\frac{4}{\sqrt{3}}\right)^3$

$= 154.77...$

$\approx 155 \text{ cm}^2$ (3 s.f.)

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Question 7 continued

(Total for Question 7 is 9 marks)

8

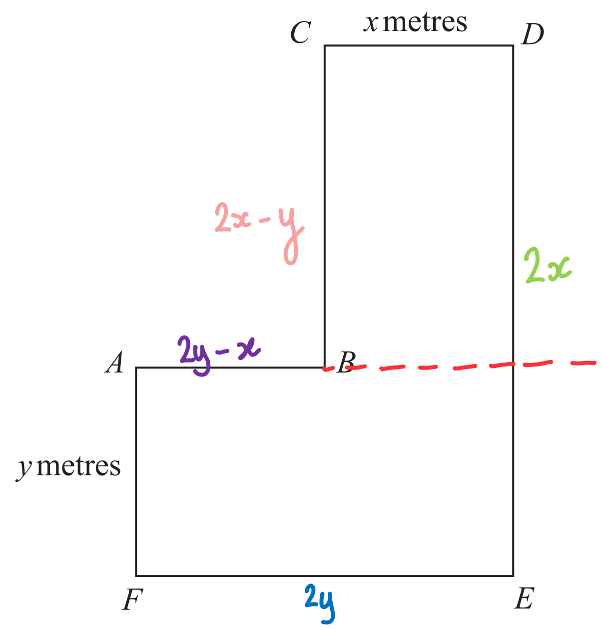

Diagram **NOT** accurately drawn

Figure 3

Figure 3 shows the plan of a floor *ABCDEF* in which all the corners are right angles and

$CD = x$ metres $\qquad AF = y$ metres

The length of *DE* is twice the length of *CD*.
The length of *FE* is twice the length of *AF*.

The perimeter of the floor plan is 68 metres.

(a) Find and simplify an equation in terms of x and y for this information.
(2)

The area of the floor plan is $248\,\text{m}^2$

(b) Show that $2y^2 + 2x^2 - xy = 248$
(3)

(c) Find the possible lengths of *AB*.
Show clear algebraic working.
(5)

(a) The perimeter is the sum of all sides.

$(x) + (y) + (2x) + (2y) + (2y - x) + (2x - y) = 68$

$4x + 4y = 68$

$x + y = 17$

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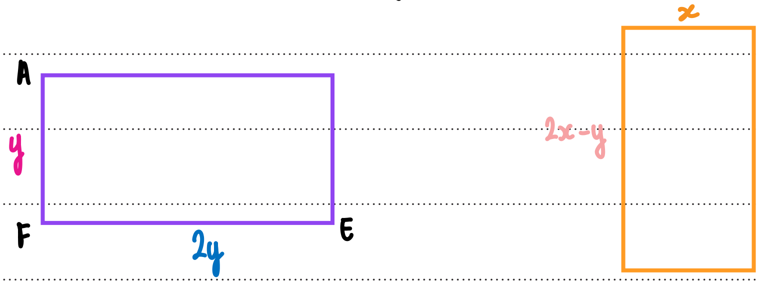
Question 8 continued

(b) You can separate the shape into 2 rectangles and find the area of each separately.



Area of a rectangle = base × height

Rectangle 1: $(2y) \times (y) = 2y^2$

Rectangle 2: $(2x-y) \times (x) = 2x^2 - xy$

Rectangle 1 + Rectangle 2 = 248

$$2y^2 + 2x^2 - xy = 248$$

(c) You can solve simultaneously for parts (a) and (b).

$$x + y = 17$$

$$2y^2 + 2x - xy = 248$$

Make x the subject of equation 1:

$$x = 17 - y$$

Substitute into equation 2:

$$2y^2 + 2(17-y)^2 - (17-y)y = 248$$

$$2y^2 + 2(289 - 17y - 17y + y^2) - (17y - y^2) = 248$$

$$2y^2 + 2(289 - 34y + y^2) - 17y + y^2 = 248$$

$$2y^2 + 578 - 68y + 2y^2 - 17y + y^2 = 248$$

$$5y^2 - 85y + 578 = 248$$

Question 8 continued

$$5y^2 - 85y + 330 = 0$$

$$y^2 - 17y + 66 = 0$$

$$(y-11)(y-6) = 0$$

$$y-11=0 \qquad y-6=0$$

$$y_1 = 11 \qquad y_2 = 6$$

Sub values of y to find values of x.

$$x_1 = 17 - (11)$$

$$x_1 = 6$$

$$x_2 = 17 - (6)$$

$$x_2 = 11$$

$AB = 2y - x$

$AB_1 = 2y_1 - x_1$

$AB_1 = 2(11) - (6)$

$AB_1 = 16$ cm

$AB_2 = 2y_2 - x_2$

$AB_2 = 2(6) - (11)$

$AB_2 = 1$ cm

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Question 8 continued

(Total for Question 8 is 10 marks)

9 $\quad \mathbf{A} = \begin{pmatrix} 3 & 4 \\ -1 & 2 \end{pmatrix} \qquad \mathbf{B} = \begin{pmatrix} 3 & -1 \\ 2 & -2 \end{pmatrix}$

The transformation with matrix **A** is equivalent to the transformation with matrix **B** followed by the transformation with matrix **C**, where **C** is a 2 × 2 matrix.

Find matrix **C**.

(5)

First form an equation using A, B and C.

$$A = BC$$

$$\begin{pmatrix} 3 & 4 \\ -1 & 2 \end{pmatrix} = C \begin{pmatrix} 3 & -1 \\ 2 & -2 \end{pmatrix}$$

Divide A by B.

$$\begin{pmatrix} 3 & 4 \\ -1 & 2 \end{pmatrix} \div \begin{pmatrix} 3 & -1 \\ 2 & -2 \end{pmatrix} = C$$

Since you cannon divide by a matrix directly, find the inverse of B.

$\left[\text{The inverse of matrix } \begin{pmatrix} a & b \\ c & d \end{pmatrix} \text{ is } \frac{1}{ad - bc} \begin{pmatrix} d & -b \\ -c & a \end{pmatrix}\right]$

$$\begin{pmatrix} 3 & -1 \\ 2 & -2 \end{pmatrix}^{-1} = \frac{1}{(3)(-2)-(-1)(2)} \begin{pmatrix} (-2) & -(-1) \\ -(2) & (3) \end{pmatrix}$$

$$= -\frac{1}{4} \begin{pmatrix} -2 & 1 \\ -2 & 3 \end{pmatrix}$$

$$B^{-1} = -\frac{1}{4} \begin{pmatrix} -2 & 1 \\ -2 & 3 \end{pmatrix}$$

Rule for multiplying a 2×2 matrix by a 2×2 matrix:

$$\begin{pmatrix} a_1 & b_1 \\ c_1 & d_1 \end{pmatrix} \begin{pmatrix} a_2 & b_2 \\ c_2 & d_2 \end{pmatrix} = \begin{pmatrix} a_1 a_2 + b_1 c_2 & a_1 b_2 + b_1 d_2 \\ c_1 a_2 + d_1 c_2 & c_1 b_2 + d_1 d_2 \end{pmatrix}$$

$\left[\text{The inverse of matrix } \begin{pmatrix} a & b \\ c & d \end{pmatrix} \text{ is } \frac{1}{ad - bc} \begin{pmatrix} d & -b \\ -c & a \end{pmatrix}\right]$

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Question 9 continued

$$C = A \times B^{-1}$$

$$C = \begin{pmatrix} 3 & 4 \\ -1 & 2 \end{pmatrix} \times -\frac{1}{4}\begin{pmatrix} -2 & 1 \\ -2 & 3 \end{pmatrix}$$

$$= -\frac{1}{4}\begin{pmatrix} (3)(-2)+(4)(-2) & (3)(1)+(4)(3) \\ (-1)(-2)+(2)(-2) & (-1)(1)+(-2)(3) \end{pmatrix}$$

$$= -\frac{1}{4}\begin{pmatrix} -14 & 15 \\ -2 & 5 \end{pmatrix}$$

(Total for Question 9 is 5 marks)

10 Triangle ABC has sides $AB = 10$ cm, $BC = 7$ cm and $CA = 6$ cm.

(a) Calculate the area, in cm^2 to 3 significant figures, of triangle ABC.

(5)

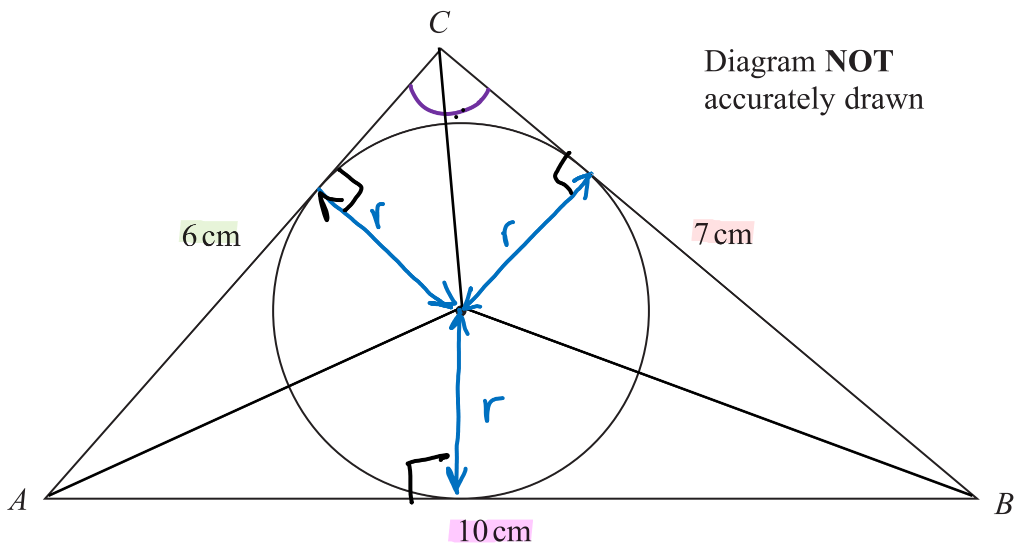

Figure 4

Figure 4 shows triangle ABC and a circle inside the triangle so that each side of the triangle is a tangent to the circle.

(b) Calculate the radius, in cm to 2 significant figures, of the circle.

(3)

(a) You can find cosine to find the angle ACB and then use $\frac{1}{2}ab\sin C$ for area.

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

where $a = 10$cm

$b = 6$cm

$c = 7$cm

$A = ACB$

$(10)^2 = (6)^2 + (7)^2 - 2(6)(7)\cos ACB$

$(10)^2 - (6)^2 - (7)^2 = -2(6)(7)\cos ACB$

$\dfrac{(10)^2 - (6)^2 - (7)^2}{-2(6)(7)} = \cos ACB$

$$\left[\begin{array}{c}\text{Cosine rule: } a^2 = b^2 + c^2 - 2bc\cos A \\ \text{Area of triangle} = \dfrac{1}{2}ab\sin C\end{array}\right]$$

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Question 10 continued

$\cos^{-1}\left(\frac{(10)^2-(6)^2-(7)^2}{-2(6)(7)}\right) = ACB$

$100.2865... = ACB$

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

where $a = 6$cm

$b = 7$cm

$C = 100.2865...$

Area $= \frac{1}{2}(6)(7)\sin(100.2865...)$

$= 20.662...$

$\approx 20.7 \text{ cm}^2$

(b) Since you have found the area, split the triangle into 3 smaller triangles and solve for r.

$\frac{1}{2}(10)(r) + \frac{1}{2}(6)(r) + \frac{1}{2}(7)(r) = 20.662...$

$\frac{10}{2}r + \frac{6}{2}r + \frac{7}{2}r = 20.662...$

$\frac{23}{2}r = 20.66...$

$r = 1.7967...$

$r \approx 1.8$cm

Question 10 continued

Question 10 continued

(Total for Question 10 is 8 marks)

11 Find the range of values of x for which both

$$2x + 3(4 - 3x) < 8x \quad \textbf{and} \quad 6x - 5 \leqslant (2x - 3)^2$$

Show clear algebraic working.

(7)

First expand and simplify both.

$2x + 3(4 - 3x) < 8x$

$2x + 12 - 9x < 8x$

$12 - 7x < 8x$

$12 < 15x$

$\frac{12}{15} < x$

$\frac{4}{5} < x$

$6x - 5 \leqslant (2x - 3)(2x - 3)$

$6x - 5 \leqslant 4x^2 - 6x - 6x + 9$

$6x - 5 \leqslant 4x^2 - 12x + 9$

$6x \leqslant 4x^2 - 12x + 14$

$0 \leqslant 4x^2 - 18x + 14$

$0 \leqslant 2x^2 - 9x + 7$

$2 \times 7 = 14$

$0 \leqslant \frac{(2x - 7)(\cancel{2}x - \cancel{2}^{1})}{\cancel{2}}$

$0 \leqslant (2x - 7)(x - 1)$

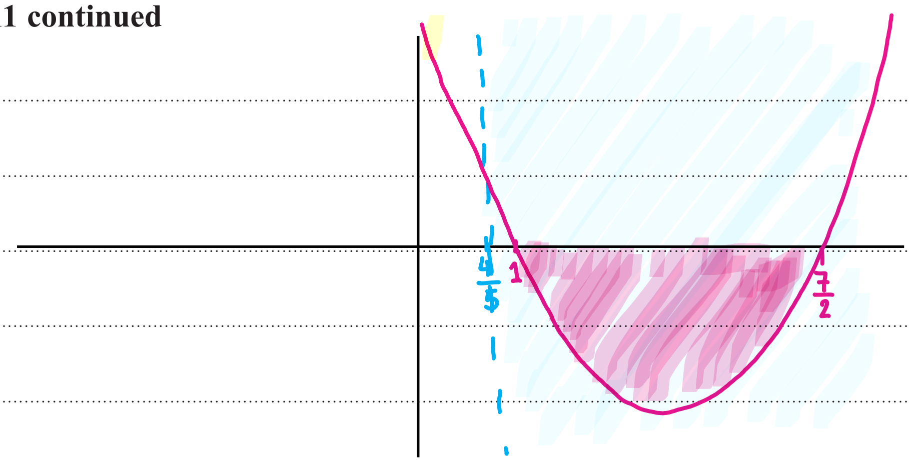
$2x - 7 = 0$ $\qquad$ $x - 1 = 0$

$2x = 7$ $\qquad$ $x = 1$

$x = \frac{7}{2}$

You can now draw a graph to find area of inequality

Question 11 continued



$0 \leq (2x-7)(x-1)$

$\frac{4}{5} < x$

$\therefore \quad x > \frac{4}{5} \quad$ and $\quad 1 \leq x \leq \frac{7}{2}$

(Total for Question 11 is 7 marks)

12 A company produces bird food made with sunflower seeds, corn and millet.

The weights of sunflower seeds, corn and millet in each bag of the bird food are in the ratios

sunflower seeds : corn : millet = 8 : 3 : 1

The total weight of the bird food in each bag is 30 kg.

(a) Calculate the weight, in kg, of corn in each bag of the bird food.

(2)

Tom buys bags of the bird food from the company and sells them in his shop.

He sells each bag for $15.04
He makes a profit of 17.5% on each bag he sells.

(b) Calculate, in $, how much Tom pays the company for each bag of the bird food he buys.

(2)

The bags are filled with the bird food at a rate of 530 grams per second.

(c) Calculate the number of bags of the bird food that are filled completely in 6 hours.

(4)

Sunflower seeds cost £150.75 for 30 kg from farmer *A*.
Sunflower seeds cost $162.35 for 25 kg from farmer *B*.

Using an exchange rate of £1 = $1.315

(d) find which of the two farmers, *A* or *B*, sells sunflower seeds at the cheaper cost per kilogram.
You must give a reason for your answer.

(3)

(a) S : C : M

8 : 3 : 1

First calculate constant of proportionality for 30g.

$COP = \frac{30}{8+3+1}$

$= \frac{5}{2}$

Weight of corn: $3 \times \frac{5}{2} = \underline{7.5\text{kg}}$

(b) If Tom makes 17.5% profit, he must sell the bags at 117.5% of the original price.

Original price $\times \frac{117.5}{100} = 15.04$

Original price $= \underline{\$12.8}$

Question 12 continued

(b) If each bag contains 30g, calculate number of bags filled every second.

number of bags filled every second : $\frac{530}{30\,000} = \frac{53}{3000}$ bags

Calculate how many bags filled in 6 hours

6 hours = 21600 seconds

$21600 \times \frac{53}{3000} = 381.6$

≈ 381 bags

(d) Find the price for 1kg of each in dollars.

Farmer A:

Convert £ to $

$150.75 \times 1.315 = 198.23625$

Price : Amount

\$198.23625 : 30kg

\$6.607875 : 1kg

\$6.607... ≈ \$6.61

Farmer B:

Price : Amount

\$162.35 : 25kg

\$6.494 : 1kg

\$6.494 ≈ \$6.50

\$6.61 > \$6.50

∴ Farmer B sells at a cheaper rate

Question 12 continued

(Total for Question 12 is 11 marks)

TOTAL FOR PAPER IS 100 MARKS