Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics B

Paper 2

Tuesday 21 May 2013 – Morning
Time: 2 hours 30 minutes

Paper Reference
4MB0/02

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 ▶

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P 4 2 0 6 5 A 0 1 3 2

PEARSON

Answer ALL ELEVEN questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1

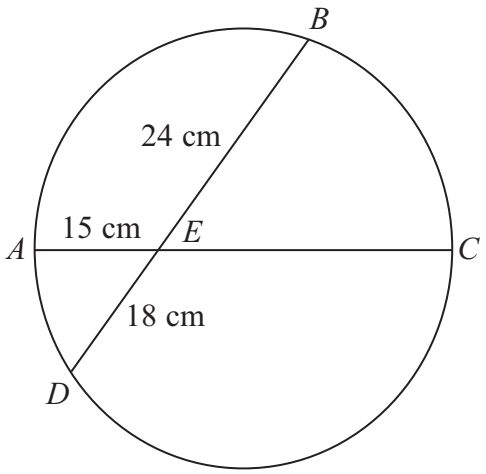


Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows a circle *ABCD*. The diameter *AC* and the chord *BD* intersect at *E*. Given that *AE* = 15 cm, *DE* = 18 cm and *EB* = 24 cm, calculate the length, in cm, of a diameter of the circle.

(Total for Question 1 is 3 marks)

2

Mark	1	2	3	4	5
Frequency	4	10	15	x	17

The table shows the distribution of a set of marks.

Given that the mean mark is 3.5

(a) write down an equation in x.

(1)

(b) Solve your equation for x.

(2)

(c) Write down the modal mark.

(1)

(Total for Question 2 is 4 marks)

3

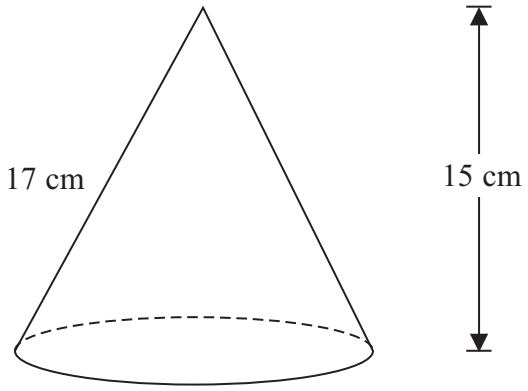


Diagram **NOT** accurately drawn

Figure 2

Figure 2 shows a solid right circular cone with a height of 15 cm and a slant height of 17 cm.

(a) Calculate the radius, in cm, of the cone.

(2)

(b) Show that the total surface area is $200\pi \text{cm}^2$.

(2)

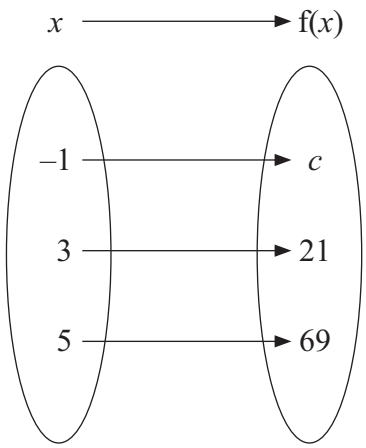
[Area of a circle = πr^2

Curved surface area of a right circular cone = πrl]

Question 3 continued

(Total for Question 3 is 4 marks)

4



A quadratic function, $f: x \mapsto ax^2 + b$, is represented by the mapping diagram shown.

(a) Use the diagram to write down **two** equations in a and b.

(2)

(b) Find the value of

(i) a

(ii) b

(3)

(c) Calculate the value of c.

(2)

Question 4 continued

(Total for Question 4 is 7 marks)

5 The points $A(2, 1)$, $B(2, 3)$ and $C(3, 4)$ are the vertices of ΔABC

(a) On the grid, plot, draw and label ΔABC

(1)

The ΔABC is transformed onto $\Delta A'B'C'$ by the transformation with matrix **S** where

$$\mathbf{S} = \begin{pmatrix} 1 & -1 \\ 3 & -1 \end{pmatrix}$$

The matrix $\mathbf{T} = \begin{pmatrix} 2 & 2 & 3 \\ 1 & 3 & 4 \end{pmatrix}$

(b) Calculate the matrix product **ST**.

(2)

(c) Hence plot, draw and label $\Delta A'B'C'$ on the grid.

(1)

The $\Delta A'B'C'$ is then transformed onto $\Delta A''B''C''$ by the transformation with matrix **S**.

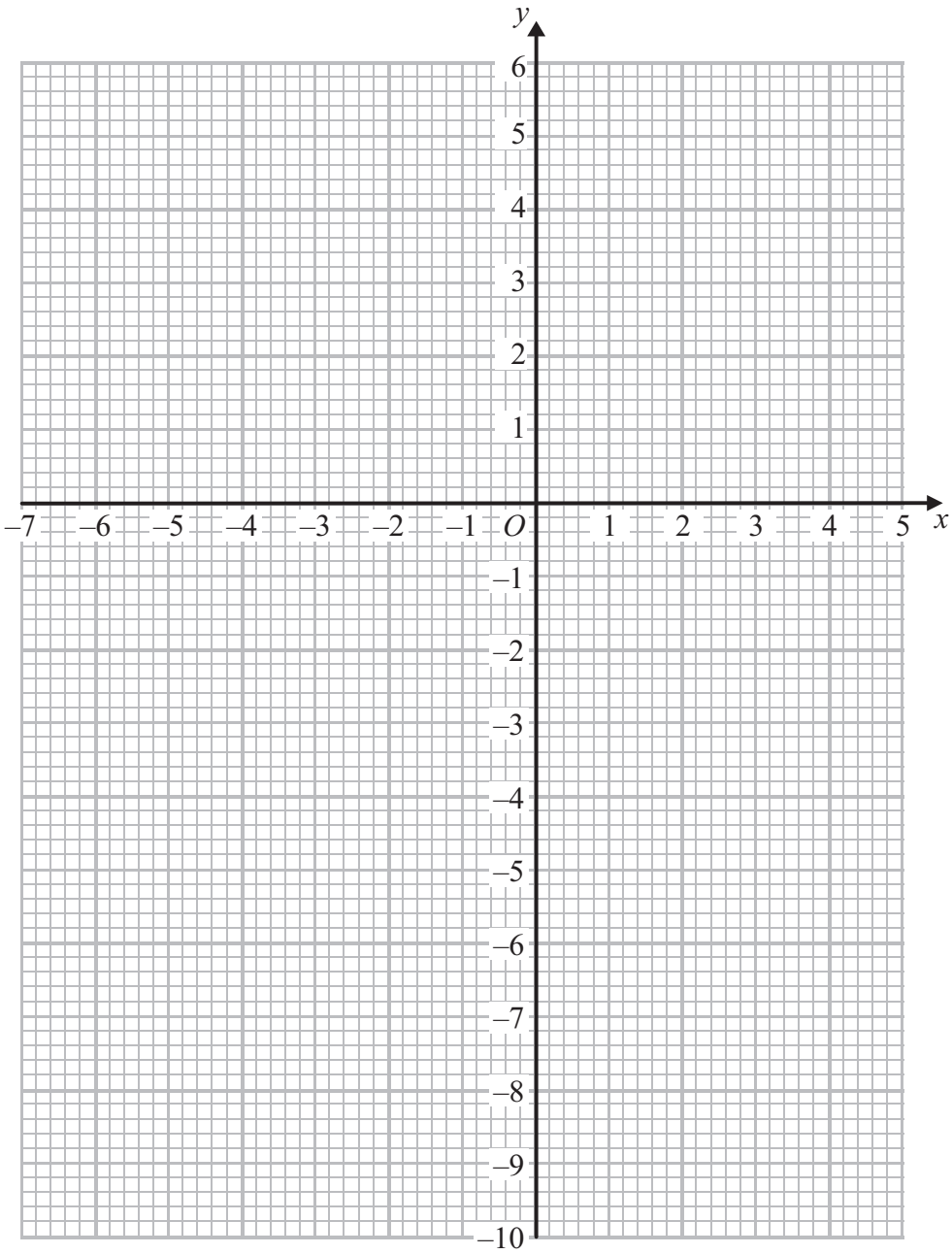
(d) On the grid, plot, draw and label $\Delta A''B''C''$

(3)

(e) Describe fully the single transformation which transforms ΔABC onto $\Delta A''B''C''$

(3)

Question 5 continued



Question 5 continued

(Total for Question 5 is 10 marks)

6 Preecha arrived at a London airport to take a flight to Bangkok. He changed £800 (British pound) to Thai baht. The exchange rate was £1 = 49.22 Thai baht.

(a) Calculate how many Thai baht Preecha receives.

(2)

Unfortunately, as a result of a volcanic ash cloud, he did not travel. He changes all of his Thai baht back to British pounds. The exchange rate was £1 = 60.05 Thai baht.

(b) Calculate how much money, to the nearest £, he lost as a result of these two exchanges.

(3)

(Total for Question 6 is 5 marks)

7

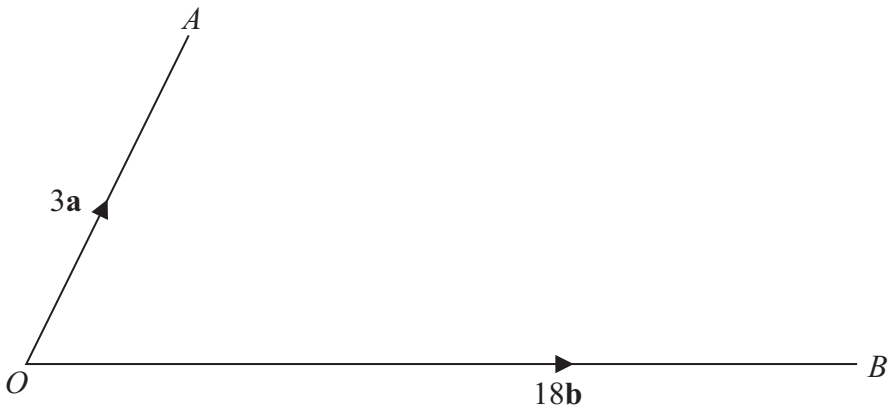


Figure 3

In Figure 3, $\overrightarrow{OA} = 3\mathbf{a}$ and $\overrightarrow{OB} = 18\mathbf{b}$.

(a) Write down $\overrightarrow{AB}$ in terms of **a** and **b**.

(1)

The point C is on OA such that $OC : OA = 2 : 3$

The point D is on OB such that $OD : OB = 1 : 3$

(b) Find $\overrightarrow{CD}$ in terms of **a** and **b**.

(2)

X is the midpoint of CD.

(c) Find $\overrightarrow{OX}$ in terms of **a** and **b**. Simplify your answer.

(2)

OX is extended to the point Y so that $\overrightarrow{OY} = \mu\,\overrightarrow{OX}$.

(d) Write down, in terms of μ, **a** and **b**, an expression for $\overrightarrow{OY}$.

(1)

Given also that the point Y is such that $\overrightarrow{OY} = \overrightarrow{OC} + \lambda\,\overrightarrow{OB}$,

(e) write down, in terms of λ, **a** and **b**, another expression for $\overrightarrow{OY}$.

(1)

(f) Find the value of μ and the value of λ.

(3)

(g) Hence, write down the ratio of $CY : OB$

Express your answer in the form $m : n$ where m and n are integers.

(1)

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 11 marks)

8 At *Trafalgar High* school 120 students took examinations in Mathematics (M), English (E) and Science (S). Every student passed at least one of these subjects and x pupils passed all three subjects.

25 students passed both Mathematics and English.

(a) Write down an expression in terms of x for the number of students who passed both Mathematics and English but not Science.

(1)

Given that

18 students passed both Mathematics and Science
17 students passed both English and Science
21 students passed Mathematics only
22 students passed English only
37 students passed Science only

(b) show all this information on Figure 4.

(3)

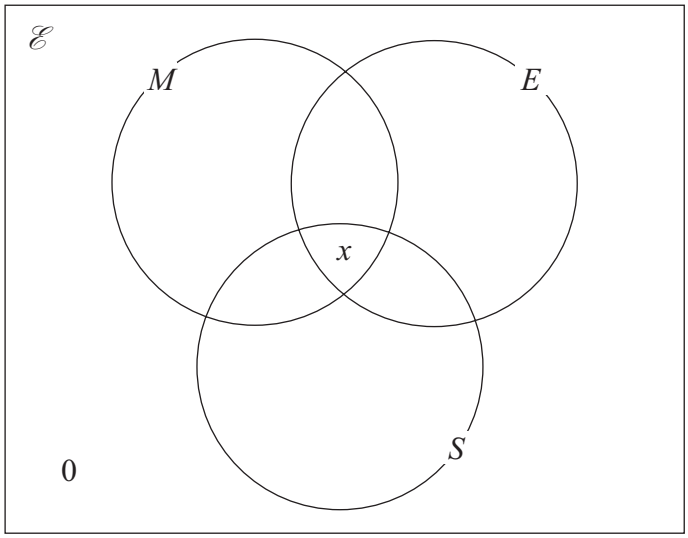


Figure 4

(c) Find the value of x.

(2)

(d) Find the value of

(i) $n(M \cup S)$
(ii) $n(M \cap E \cap S')$

(2)

A student is to be chosen at random from the 120 who took examinations in Mathematics, English and Science.

(e) Given that this student passed the Science examination, find the probability that the student also passed the English examination.

(3)

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 11 marks)

9

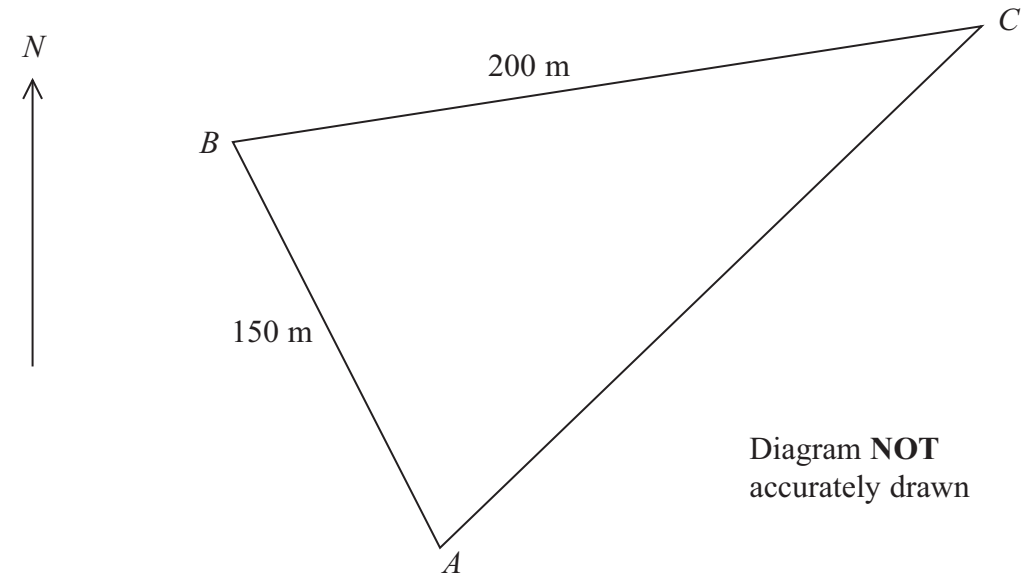


Figure 5

Figure 5 shows the location of three markers A, B and C positioned on the surface of a lake. The distance of A from B is 150 m and the distance of B from C is 200 m. The bearing of B from A is 330° and the bearing of A from C is 220°.

(a) Show that the size of $\angle BAC$ is 70°.

(2)

(b) Find, giving your answer to 3 significant figures,

(i) the size, in degrees, of $\angle BCA$,

(3)

(ii) the bearing of C from B,

(2)

(iii) the distance, in m, of A from C.

(3)

Two boats, P and Q, take part in a race. Each boat starts at A and travels around triangle ABC **four** times finishing at A.

Boat P starts the race and travels at an average speed of 1.5 m/s.

(c) Find the time, to the nearest second, for boat P to complete the race.

(3)

Boat Q starts 3 minutes after boat P has started and finishes at A at the same time as boat P.

(d) Calculate the average speed, in m/s, of boat Q.

(3)

[Sine rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$]

Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 16 marks)

10

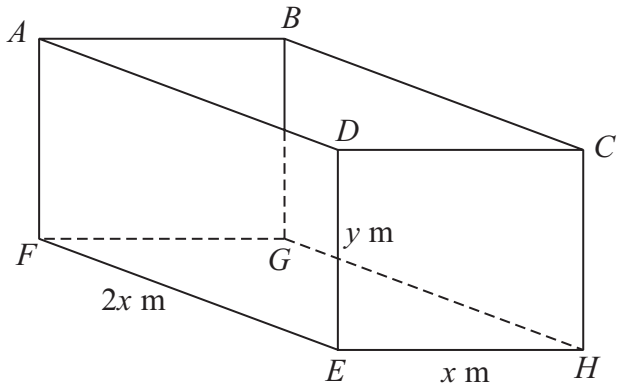


Figure 6

Figure 6 shows an open rectangular tank *ABCDEFGH* with the top *ABCD* open.
$EH = x$ metres, $EF = 2x$ metres and $ED = y$ metres.

The volume of the tank is 16 m^3.

(a) Find and simplify an expression for y in terms of x.

(2)

The inside of the tank is to be painted.

(b) Show that the surface area of the tank to be painted, S m^2, is given by

$$S = 2x^2 + \frac{48}{x}$$

(2)

Question 10 continues on page 26

Question 10 continued

Question 10 continued

(c) Complete the following table of values for $S = 2x^2 + \frac{48}{x}$

Give your values of S to one decimal place where necessary.

x	1	2	3	4	5	6
$2x^2$	2			32		72
$\frac{48}{x}$	48			12		8
S	50			44		80

(3)

(d) On the graph paper, plot the points from your completed table and join them to form a smooth curve for $1 \leqslant x \leqslant 6$

(3)

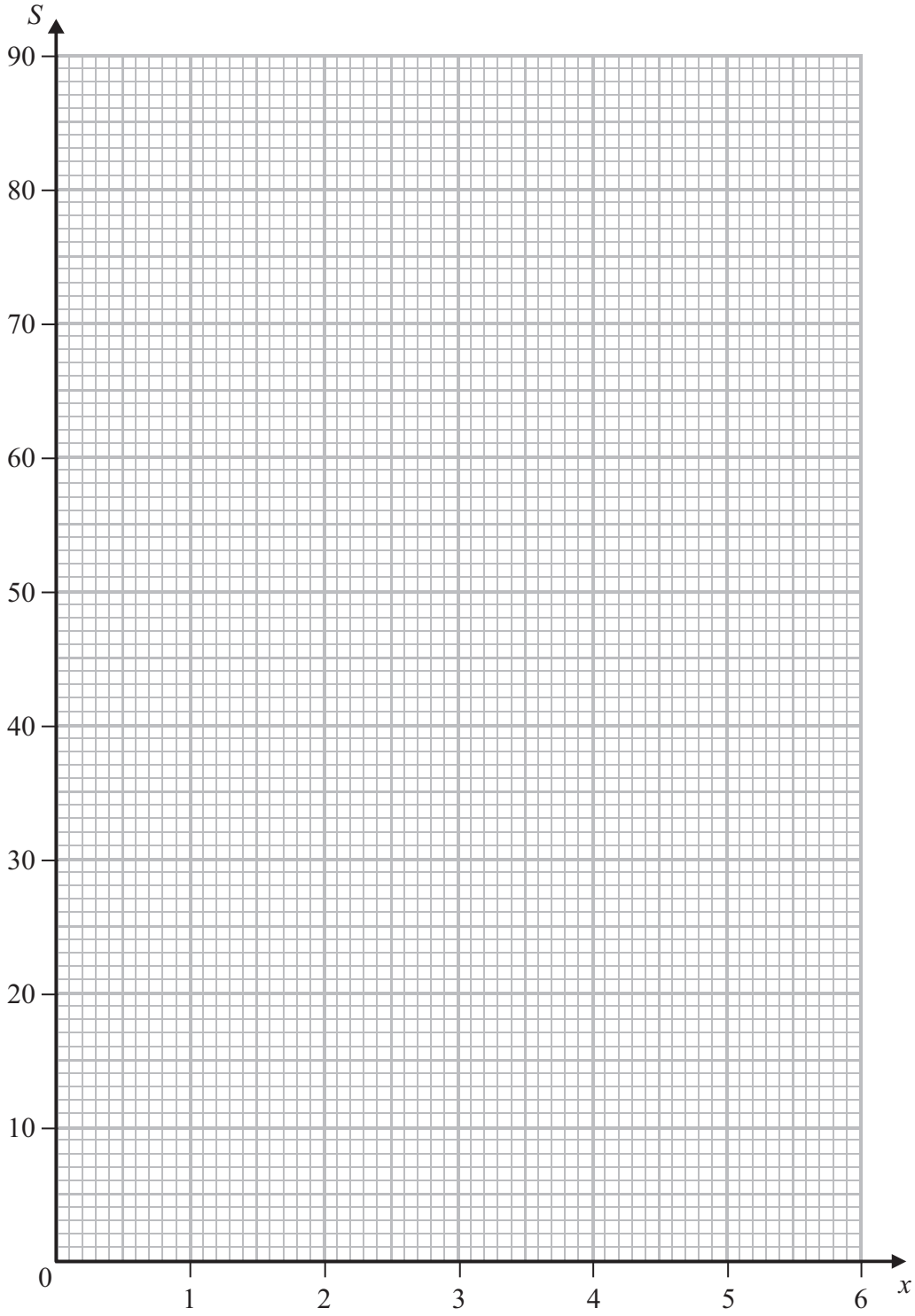
(e) When the surface area to be painted is 40 m^2, write down, to one decimal place, the two possible values of x.

(2)

(f) Use your graph to find the value of y, the height of the tank, to one decimal place, for which S is a minimum.

(4)

Question 10 continued



(Total for Question 10 is 16 marks)

11 Figure 7 shows a fair twelve-faced die which has one of the numbers from 1 to 12 on each of its faces.

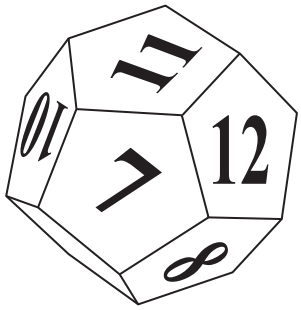


Figure 7

A game is to be played using this die between two players, *A* and *B*. Player *A* rolls the die once and if the score is a multiple of 3 then *A* wins and the game stops.

If *A* does not win, *B* has his first turn. He rolls the die and, if the score is a multiple of 3, then *B* wins and the game stops.

If *B* does not win then *A* has another turn and if *A* does not win on his second turn, *B* has another turn.

If *B* wins, the game stops.

If *B* does not win on his second turn **the game stops**.

(a) Write down all the scores on the die that are multiples of 3

(1)

(b) When the die is rolled once, write down the probability that the score is a multiple of 3

(1)

The incomplete probability tree diagram on page 29 shows the possible outcomes after each player has rolled the die once.

(c) Complete the tree diagram for the game where *A* and *B* can each have up to two rolls of the die. Label each branch of the tree diagram with the probability of the outcome that the branch represents.

(4)

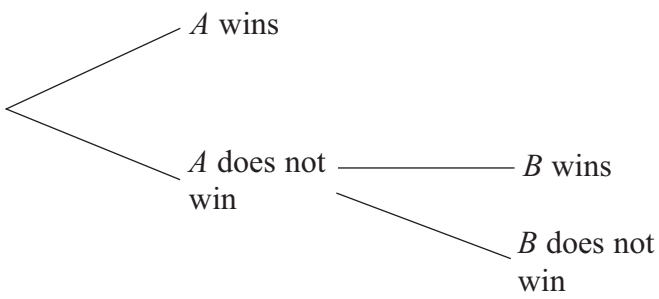
(d) Find the probability that *B* will win on his first turn.

(2)

(e) Show that the probability that *A* wins the game is greater than the probability that *B* wins the game.

(5)

Question 11 continued



Question 11 continued

Question 11 continued

(Total for Question 11 is 13 marks)

TOTAL FOR PAPER IS 100 MARKS

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