Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6934574930

ADDITIONAL MATHEMATICS **4037/12**

Paper 1 **October/November 2017**

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

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Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

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

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

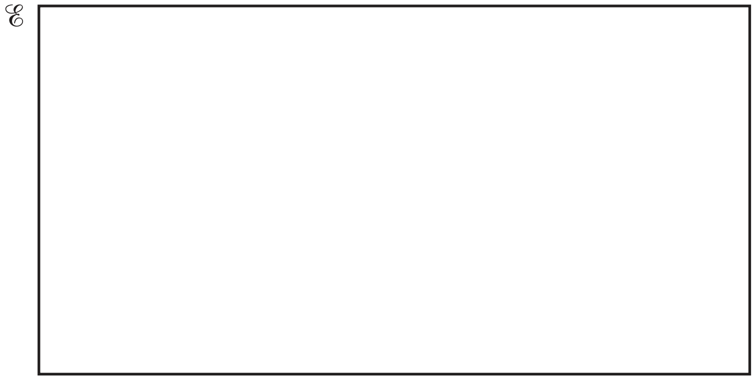
Formulae for ΔABC

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

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

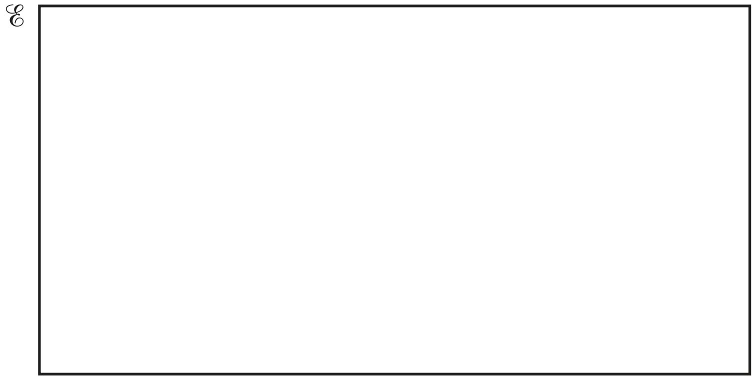
$$\Delta = \frac{1}{2} bc \sin A$$

1 **(i)** On the Venn diagram below, draw sets X and Y such that $\mathrm{n}(X \cap Y) = 0$.



[1]

(ii) On the Venn diagram below, draw sets A, B and C such that $C \subset (A \cup B)'$.



[2]

2 The graph of $y = a\sin(bx) + c$ has an amplitude of 4, a period of $\frac{\pi}{3}$ and passes through the point $\left(\frac{\pi}{12}, 2\right)$. Find the value of each of the constants a, b and c. [4]

3 **(i)** Find, in ascending powers of x, the first 3 terms in the expansion of $\left(2-\frac{x^2}{4}\right)^5$. [3]

(ii) Hence find the term independent of x in the expansion of $\left(2-\frac{x^2}{4}\right)^5\left(\frac{1}{x}-\frac{3}{x^2}\right)^2$. [3]

4 Given that $y = \dfrac{\ln(3x^2 + 2)}{x^2 + 1}$, find the value of $\dfrac{dy}{dx}$ when $x = 2$, giving your answer as $a + b\ln 14$, where a and b are fractions in their simplest form. [6]

5 When $\lg y$ is plotted against x, a straight line is obtained which passes through the points (0.6, 0.3) and (1.1, 0.2).

(i) Find $\lg y$ in terms of x. [4]

(ii) Find y in terms of x, giving your answer in the form $y = A(10^{bx})$, where A and b are constants. [3]

6 Functions f and g are defined, for $x > 0$, by

$$f(x) = \ln x,$$
$$g(x) = 2x^2 + 3.$$

(i) Write down the range of f. [1]

(ii) Write down the range of g. [1]

(iii) Find the exact value of $f^{-1}g(4)$. [2]

(iv) Find $g^{-1}(x)$ and state its domain. [3]

7 A polynomial $\mathrm{p}(x)$ is $ax^3 + 8x^2 + bx + 5$, where a and b are integers. It is given that $2x - 1$ is a factor of $\mathrm{p}(x)$ and that a remainder of –25 is obtained when $\mathrm{p}(x)$ is divided by $x + 2$.

(i) Find the value of a and of b. [5]

(ii) Using your values of a and b, find the exact solutions of $\mathrm{p}(x) = 5$. [2]

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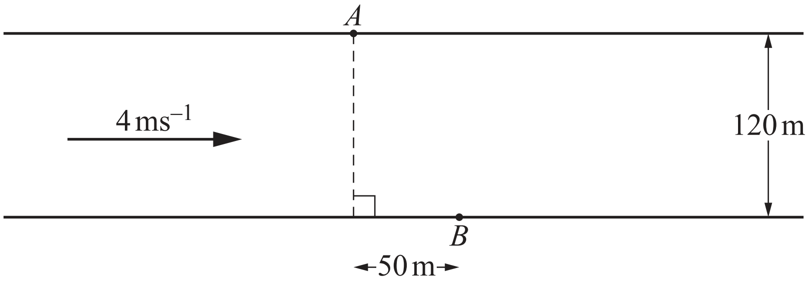
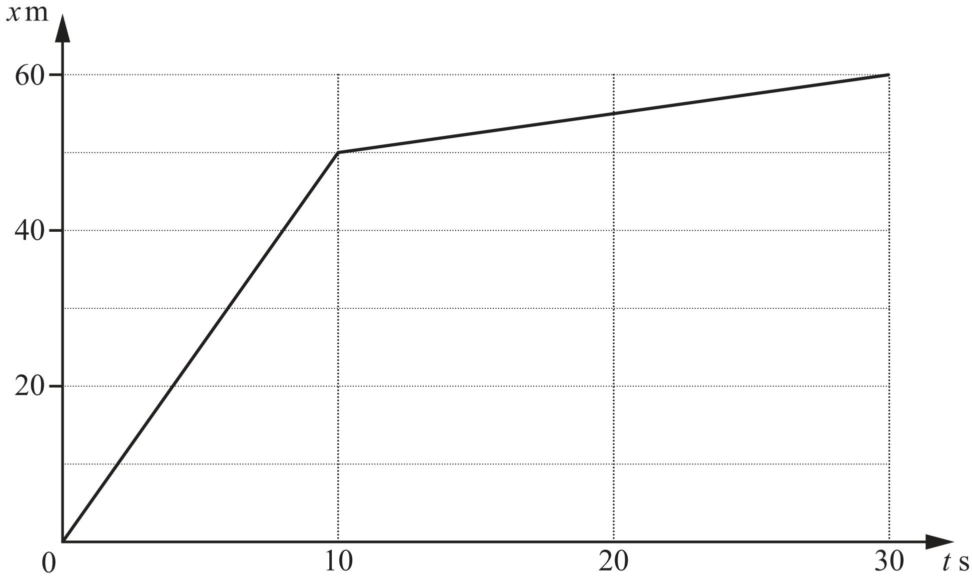


The diagram shows a river which is 120 m wide and is flowing at $4\,\text{ms}^{-1}$. Points A and B are on opposite sides of the river such that B is 50 m downstream from A. A man needs to cross the river from A to B in a boat which can travel at $5\,\text{ms}^{-1}$ in still water.

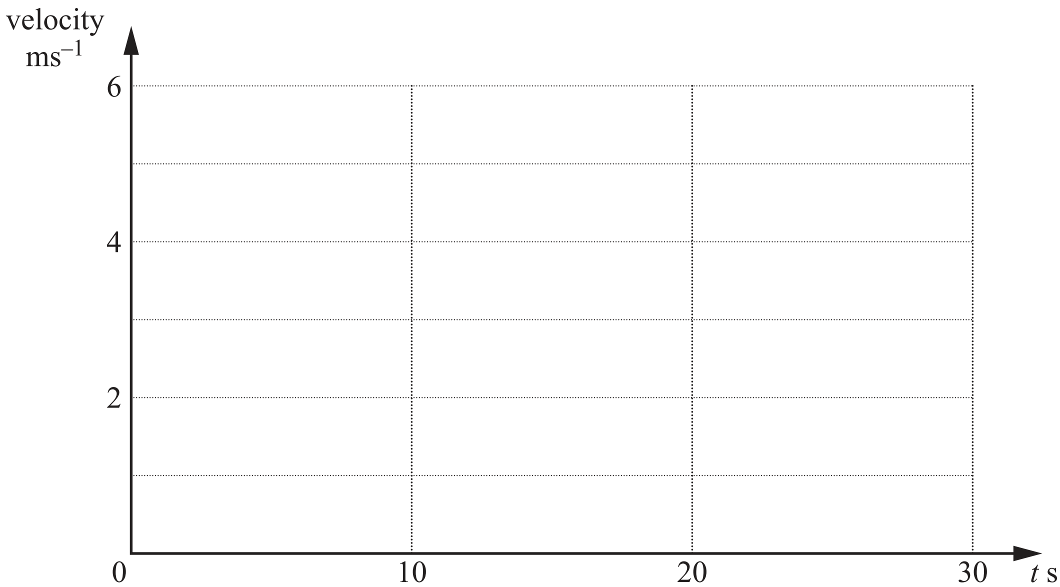
(i) Show that the man must point his boat upstream at an angle of approximately 65° to the bank. [4]

(ii) Find the time the man takes to cross the river from A to B. [6]

9 (a)



The diagram shows the displacement-time graph of a particle P which moves in a straight line such that, t s after leaving a fixed point O, its displacement from O is x m. On the axes below, draw the velocity-time graph of P.



[3]

(b) A particle Q moves in a straight line such that its velocity, v ms^{-1}, t s after passing through a fixed point O, is given by $v = 3e^{-5t} + \frac{3t}{2}$, for $t \geqslant 0$.

(i) Find the velocity of Q when $t = 0$. [1]

(ii) Find the value of t when the acceleration of Q is zero. [3]

(iii) Find the distance of Q from O when $t = 0.5$. [4]

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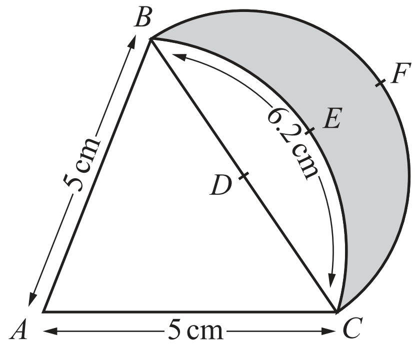

The diagram shows an isosceles triangle ABC, where $AB = AC = 5\,\text{cm}$. The arc BEC is part of the circle centre A and has length $6.2\,\text{cm}$. The point D is the midpoint of the line BC. The arc BFC is a semi-circle centre D.

(i) Show that angle BAC is 1.24 radians. [1]

(ii) Find the perimeter of the shaded region. [3]

(iii) Find the area of the shaded region. [4]

11 **(a)** Solve $2\cot(\phi + 35^\circ) = 5$ for $0^\circ \leqslant \phi \leqslant 360^\circ$. [4]

Question 11(b) is printed on the next page.

(b) **(i)** Show that $\dfrac{\sec\theta}{\cot\theta + \tan\theta} = \sin\theta$. [3]

(ii) Hence solve $\dfrac{\sec 3\theta}{\cot 3\theta + \tan 3\theta} = -\dfrac{\sqrt{3}}{2}$ for $-\dfrac{\pi}{2} \leqslant \theta \leqslant \dfrac{\pi}{2}$, giving your answers in terms of π. [4]