

Cambridge IGCSE[™]

| CANDIDATE NAME | | | | | |
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| CENTRE NUMBER | | | CANDIDATE NUMBER | | |

989699444

ADDITIONAL MATHEMATICS

0606/12

Paper 1 May/June 2022

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer all questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do not use an erasable pen or correction fluid.
- Do not write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [].

This document has 16 pages. Any blank pages are indicated.

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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

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

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

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series

$$u_n = ar^{n-1}$$
 $S_n = \frac{a(1-r^n)}{1-r} \ (r \neq 1)$
 $S_{\infty} = \frac{a}{1-r} \ (|r| < 1)$

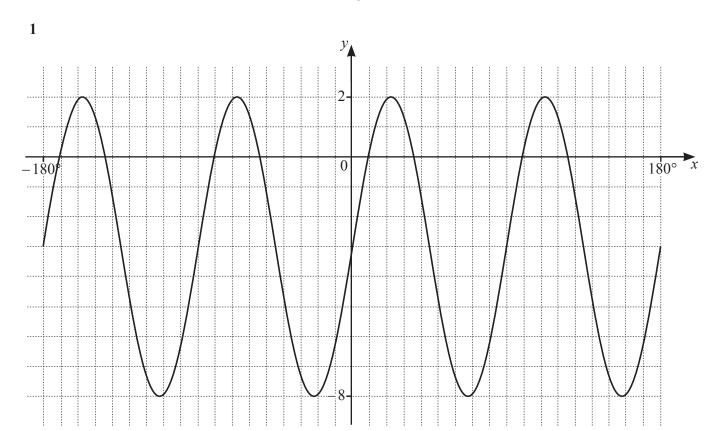
2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\csc^2 A = 1 + \cot^2 A$$

Formulae for $\triangle ABC$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$
$$a^2 = b^2 + c^2 - 2bc \cos A$$
$$\Delta = \frac{1}{2}bc \sin A$$



The diagram shows the graph of $y = a \sin bx + c$, where a, b and c are integers, for $-180^{\circ} \le x \le 180^{\circ}$. Find the values of a, b and c. [3]

[4]

2 Given that $x = \sec^2 \theta$ and $y+2 = \cot^2 \theta$, find y in terms of x.

| 3 | Variables x and y are such that, when | lg(2y+1) | is plotted against x^2 , | a straight lin | e graph j | passing |
|---|--|----------|----------------------------|----------------|-----------|---------|
| | through the points $(1, 1)$ and $(2, 5)$ is of | otained. | | | | |

(a) Find y in terms of x.

[4]

(b) Find the value of y when
$$x = \frac{\sqrt{3}}{2}$$
.

(c) Find the value of x when y = 2.

[2]

[1]

4 (a) Find the unit vector in the same direction as $\binom{-15}{8}$. [2]

(b) Given that
$$\binom{2a}{-5} + \binom{4b-12}{3} = 4\binom{b-a}{a+2b}$$
, find the values of a and b . [3]

5 The first three terms, in ascending powers of x, in the expansion of $\left(1 + \frac{x}{6}\right)^{12} (2 - 3x)^3$ can be written in the form $8 + px + qx^2$, where p and q are constants. Find the values of p and q. [8]

| 6 | The polynomial $p(x) = 6x^3 + ax^2 + 6x + b$, where a and b are integers, is divis $p(x)$ is divided by $x-2$, the remainder is 120. | sible by $2x-1$. When |
|---|--|------------------------|
| | (a) Find the values of a and b . | [4] |
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| | (b) Hence write down the remainder when $p(x)$ is divided by x . | [1] |
| | | |
| | | |

[2]

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(c) Find the value of p''(0).

7 (a) Show that
$$\frac{2}{2x+3} - \frac{1}{x-1} + \frac{1}{(x-1)^2}$$
 can be written as $\frac{8-3x}{(x-1)^2(2x+3)}$. [2]

(b) Find $\int_2^a \frac{8-3x}{(x-1)^2(2x+3)} dx$ where a > 2. Give your answers in the form $c + \ln d$, where c and d are functions of a.

| 8 | (a) | A team of 6 people is to be chosen from 10 people. Two of the people are sisters who must not be separated. Find the number of different teams that can be formed. |
|---|-----|--|
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| | (h) | A 6-character password is to be chosen from the following characters. |
| | (6) | Digits 2 4 8 |
| | | Letters x y z Symbols * # ! |
| | | No character may be used more than once in any password. Find the number of different passwords that may be chosen if |
| | | (i) there are no other restrictions, [1] |
| | | |
| | | |
| | | (ii) the password starts with two letters and ends with two digits. [3] |
| | | |
| | | |

9 The normal to the curve $y = \frac{\ln(3x^2 + 2)}{x + 1}$, at the point *A* on the curve where x = 0, meets the *x*-axis at point *B*. Point *C* has coordinates $(0, 3 \ln 2)$. Find the gradient of the line *BC* in terms of $\ln 2$. [9]

10 (a) Given the simultaneous equations

$$1gx + 21gy = 1,$$
$$x - 3y^2 = 13,$$

(i) show that
$$x^2 - 13x - 30 = 0$$
.

[4]

(ii) Solve these simultaneous equations, giving your answers in exact form.

[2]

(b) Solve the equation $\log_a x + 3 \log_x a = 4$, where a is a positive constant, giving x in terms of a. [5]

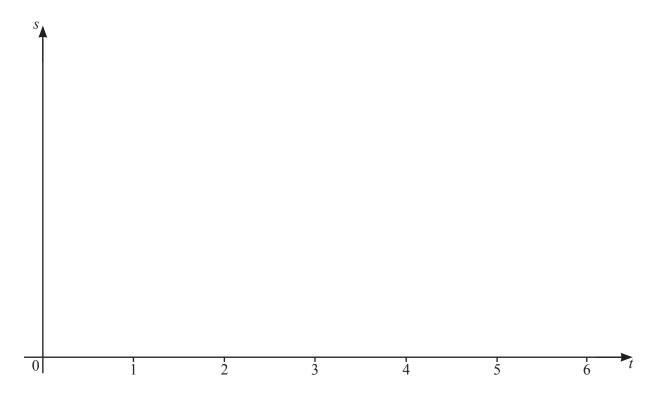
11 In this question all lengths are in kilometres and time is in hours.

A particle *P* moves in a straight line such that its displacement, *s*, from a fixed point at time *t* is given by $s = (t+2)(t-5)^2$, for $t \ge 0$.

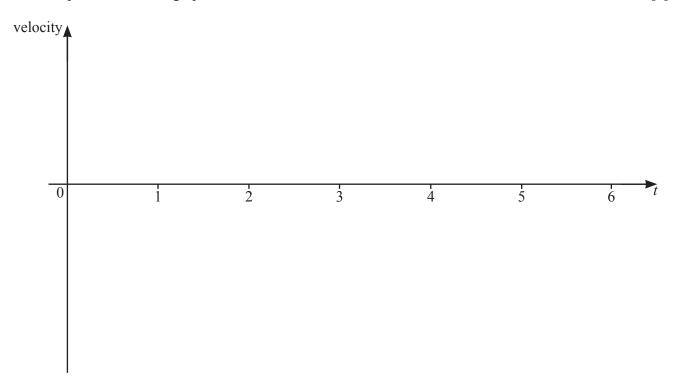
(a) Find the values of t for which the velocity of P is zero.

[4]

(b) On the axes, draw the displacement–time graph for P for $0 \le t \le 6$, stating the coordinates of the points where the graph meets the coordinate axes. [2]



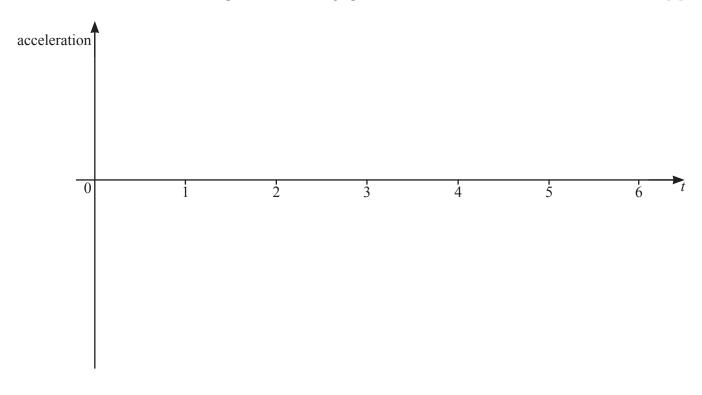
(c) On the axes below, draw the velocity–time graph for P for $0 \le t \le 6$, stating the coordinates of the points where the graph meets the coordinate axes. [2]



(d) (i) Write down an expression for the acceleration of P at time t.

(ii) Hence, on the axes below, draw the acceleration—time graph for P for $0 \le t \le 6$, stating the coordinates of the points where the graph meets the coordinate axes. [2]

[1]



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