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CANDIDATE NAME

CENTRE NUMBER

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3772962579

ADDITIONAL MATHEMATICS **0606/23**

Paper 2 **October/November 2021**

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

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

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

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

$$u_n = ar^{n-1}$$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\mathrm{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

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

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

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

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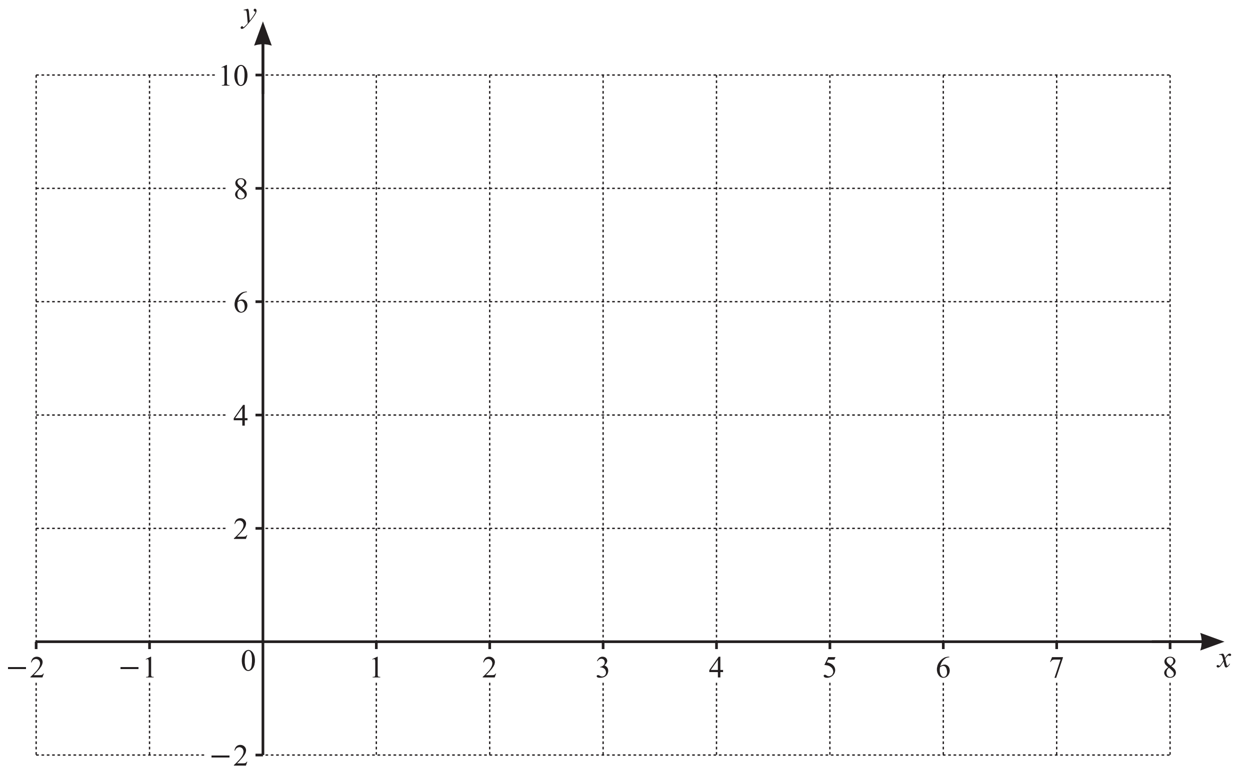
1



(a) On the axes draw the graphs of $y = |x-5|$ and $y = 6-|2x-7|$. [4]

(b) Use your graphs to solve the inequality $|x-5| > 6-|2x-7|$. [2]

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2 Solve the following simultaneous equations. Give your answers in the form $a+b\sqrt{3}$, where a and b are rational.

$$x+y=3$$
$$2x-\sqrt{3}y=5$$

[5]

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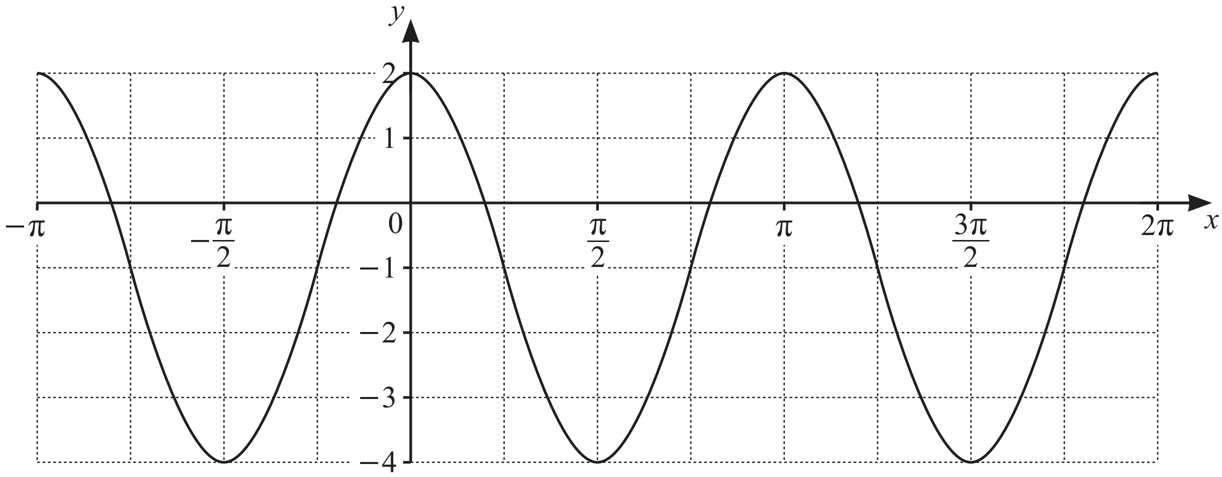
3



(a) The curve has equation $y = a\cos bx + c$ where a, b and c are integers. Find the values of a, b and c. [3]

(b) Another curve has equation $y = 2\sin 3x + 4$. Write down

(i) the amplitude, [1]

(ii) the period in radians. [1]

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4 **(a)** Solve the equation $\log_6(2x-3)=\frac{1}{2}$. Give your answer in exact form. [2]

(b) Solve the equation $\ln 2u - \ln(u-4) = 1$. Give your answer in exact form. [3]

(c) Solve the equation $\dfrac{3^v}{27^{2v-5}} = 9$. [3]

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5 **(a)** Show that $\dfrac{1}{\operatorname{cosec} x - 1} + \dfrac{1}{\operatorname{cosec} x + 1} = 2\tan x \sec x$. [4]

(b) Hence solve the equation $\dfrac{1}{\operatorname{cosec} x - 1} + \dfrac{1}{\operatorname{cosec} x + 1} = 5\operatorname{cosec} x$ for $0° < x < 360°$. [4]

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6 It is given that $x = 2 + \sec\theta$ and $y = 5 + \tan^2\theta$.

(a) Express y in terms of x. [2]

(b) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ in terms of x. [1]

(c) A curve has the equation found in **part (a)**. Find the equation of the tangent to the curve when $\theta = \frac{\pi}{3}$. [4]

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7 The vector $\mathbf{p}$ has magnitude 39 and is in the direction $-5\mathbf{i}+12\mathbf{j}$. The vector $\mathbf{q}$ has magnitude 34 and is in the direction $15\mathbf{i}-8\mathbf{j}$.

(a) Write both $\mathbf{p}$ and $\mathbf{q}$ in terms of $\mathbf{i}$ and $\mathbf{j}$. [4]

(b) Find the magnitude of $\mathbf{p}+\mathbf{q}$ and the angle this vector makes with the positive x-axis. [4]

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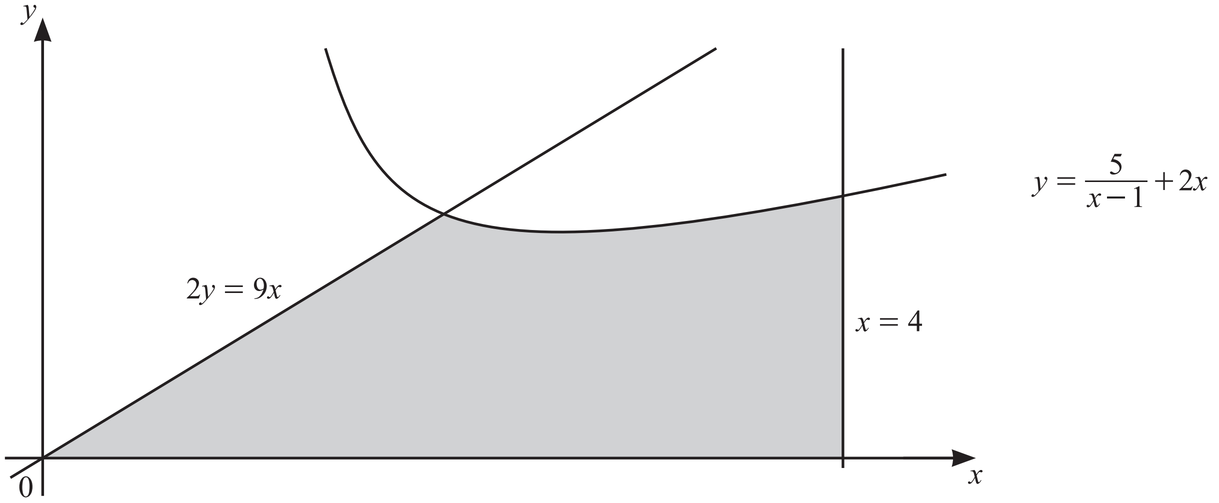
8



The diagram shows part of the curve $y = \dfrac{5}{x-1} + 2x$, and the straight lines $x = 4$ and $2y = 9x$.

(a) Find the coordinates of the stationary point on the curve $y = \dfrac{5}{x-1} + 2x$. [5]

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(b) Given that the curve and the line $2y = 9x$ intersect at the point (2, 9), find the area of the shaded region. [5]

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9 An arithmetic progression has first term a and common difference d. The third term is 13 and the tenth term is 41.

(a) Find the value of a and of d. [4]

(b) Find the number of terms required to give a sum of 2555. [4]

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(c) Given that S_n is the sum to n terms, show that $S_{2k} - S_k = 3k(1+2k)$. [4]

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10 **(a)** It is given that $f(x) = 4x^3 - 4x^2 - 15x + 18$. Find the equation of the normal to the curve $y = f(x)$ at the point where $x = 1$. [5]

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(b) DO NOT USE A CALCULATOR IN THIS PART OF THE QUESTION.

It is also given that $x+a$, where a is an integer, is a factor of $\mathrm{f}(x)$. Find a and hence solve the equation $\mathrm{f}(x)=0$. [6]

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