IYGB GCE

Core Mathematics C1

Advanced Subsidiary

Practice Paper Y

Difficulty Rating: 4.0400/2.0408

Time: 2 hours

Calculators may NOT be used in this examination.

Information for Candidates

This practice paper follows the Edexcel Syllabus.
The standard booklet “Mathematical Formulae and Statistical Tables” may be used.
Full marks may be obtained for answers to ALL questions.
The marks for the parts of questions are shown in round brackets, e.g. **(2)**.
There are 10 questions in this question paper.
The total mark for this paper is 75.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.
The examiner may refuse to mark any parts of questions if deemed not to be legible.

Question 1

a) Evaluate the following indicial expressions, giving the final answers as exact simplified fractions, where appropriate.

i. $\dfrac{6}{2^{-2}}$. $= \dfrac{6}{1} \div \dfrac{1}{4} = 24$ **(2)**

ii. $\left(1\frac{7}{9}\right)^{\frac{3}{2}}$. $= \left(\sqrt{\dfrac{16}{9}}\right)^3 = \left(\dfrac{4}{3}\right)^3 = \dfrac{64}{27}$ **(2)**

b) Solve the equation

$$z^{\frac{3}{2}} = 27 .$$ $z^{\frac{1}{2}} = 3$, $z = 9$ **(2)**

Question 2

Write each of the following surd expressions as simple as possible. $\cancel{36 \times 36 = 1296}$

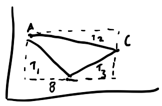
a) $\dfrac{36}{5-\sqrt{7}} \times \dfrac{5+\sqrt{7}}{5+\sqrt{7}} = \dfrac{36(5+\sqrt{7})}{25-7} = \dfrac{2(\cancel{18})(5+\sqrt{7})}{\cancel{18}} = 10+2\sqrt{7}$ **(3)**

Give the answer in the form $a+b\sqrt{7}$, where a and b are integers.

b) $\sqrt{\dfrac{8}{3}} + \dfrac{3}{2}\sqrt{\dfrac{8}{27}}$. $= \dfrac{2\sqrt{2}}{\sqrt{3}} + \dfrac{\cancel{3 \times 2}\sqrt{2}}{\cancel{2 \times 3}\sqrt{3}} = \dfrac{2\sqrt{2}}{\sqrt{3}} + \dfrac{\sqrt{2}}{\sqrt{3}} = \dfrac{3\sqrt{2}}{\sqrt{3}} = \dfrac{3\sqrt{6}}{3} = \sqrt{6}$ **(4)**

Give the answer in the form $\sqrt{k}$, where k is an integer.

Question 3



$A_{T1} = \dfrac{(5-3)(7-2)}{2} = 5$

$A_{T2} = \dfrac{(11-3)(7-4)}{2} = \dfrac{8 \times 3}{2} = 12$

$A_{T3} = \dfrac{(11-5)(4-2)}{2} = 6$

Max $X = 11$, Min $X = 3$; Max $Y = 7$, Min $Y = 2$

$dx = 8$ $dy = 5$

$A_{8} = 8 \times 5 = 40$

The points $A(3,7)$, $B(5,2)$ and $C(11,4)$ are given.

$T_1 + T_2 + T_3 + ABC = B$

Calculate the area of the triangle ABC. $\therefore B - T_1 - T_2 - T_3 = ABC$ **(3)**

$A_{ABC} = 40 - 5 - 12 - 6 = 17$

Question 4

The straight line L crosses the y axis at $(0,-1)$.

$\therefore c = -1$

The curve with equation

???

$$y = x^2 + 2x$$

has **no intersections** with L.

Determine the range of the possible values of the gradient of L. **(8)**

$x^2 + (\frac{2}{3}x - 4)^2 + 8(\frac{2}{3}x - 4) = 101$

$x^2 + \frac{4}{9}x - \cancel{\frac{16}{3}}x + 16 + \cancel{\frac{16}{3}}x - 32 - 101 = 0$

$x^2 + \frac{4}{9}x - 117 = 0$

???

Question 5

Find the coordinates of the points of intersection between

$$x^2 + y^2 + 8y = 101 \quad \text{and} \quad 2x - 3y - 12 = 0. \qquad \textbf{(7)}$$

$3y = 2x - 12$

$y = \frac{2}{3}x - 4$

Question 6

A quadratic curve C passes through the points $P(a,b)$ and $Q(2a,2b)$, where a and b are constants.

$b = a^2 - 6a + c$

The gradient at any given point on C is given by

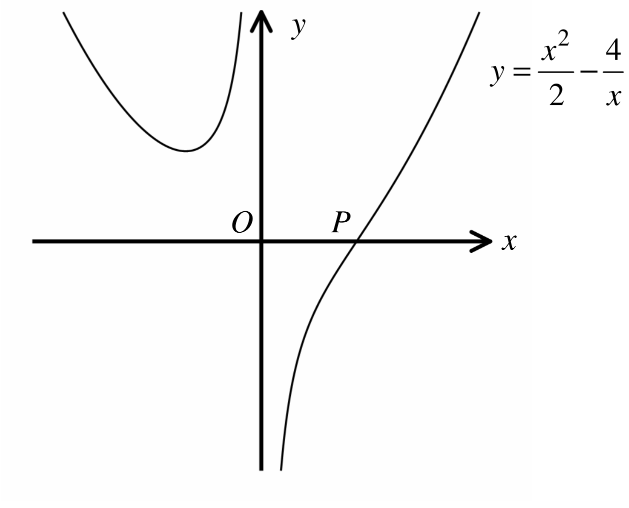
$b = \frac{4a^2 - 12a + c}{2} = 2a^2 - 6a + c$

???

$$\frac{dy}{dx} = 2x - 6. \quad y = x^2 - 6x + c$$

Find an equation for C, in terms of a. **(8)**

Question 7



The figure above shows the curve C with equation

$$y = \frac{x^2}{2} - \frac{4}{x}, \quad x \neq 0. \quad = \frac{1}{2}x^2 - 4x^{-1}$$

$$\frac{dy}{dx} = x + 4x^{-2} = x + \frac{4}{x^2}$$

The curve crosses the x axis at the point P.

The straight line L is the normal to C at P.

a) Find …

i. … the coordinates of P. $0 = \frac{x^2}{2} - \frac{4}{x}$, $0 = x^2 - \frac{8}{x}$, $0 = x^3 - 8$ $x^3 = 8$ $x = 2$ **(3)**

$(2,0)$

ii. … an equation of L. $m = x + \frac{4}{x^2} = 2 + \frac{4}{4} = 3$, $m_T = -\frac{1}{3}$ $y - y_1 = m(x - x_1)$ **(5)**

$y - 0 = -\frac{1}{3}(x - 2)$

b) Show that L does not meet C again. $\boxed{y = -\frac{1}{3}x + \frac{2}{3}}$ **(6)**

$$\frac{x^2}{2} - \frac{4}{x} = -\frac{1}{3}x + \frac{2}{3}$$

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

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

$$3x^3 + x^2 - 2x - 24 = 0$$

???

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

$n = \frac{L-a}{d}+1$ $\quad = \frac{n}{2}(a+L)$

Question 8

An arithmetic series has first term a, last term L and common difference d.

$S_n = \frac{1}{2}(L+a)\left(\frac{L-a}{d}+1\right)$

a) Show that the sum of the first n terms of the series is given by

$$\frac{1}{2}(L+a)\left(\frac{L-a}{d}+1\right). \qquad \textbf{(4)}$$

b) Hence, or otherwise, calculate the sum of all the multiples of 11 between 549 and 1101. **(2)**

$549 \div 11 \neq 0$, $550 \div 11 = 0$ $\quad 1101 \div 11 \neq 0$, $1100 \div 11 = 0$

$= \frac{1}{2}(550+1100)\left(\frac{1100-550}{11}+1\right)$

$= 42075$

Question 9

A sequence of numbers is given by the recurrence relation

$$u_{n+1} = \frac{Au_n + 2}{4 + Bu_n}, \quad n \geq 1, \quad u_1 = \frac{1}{2},$$

$-2 = \frac{0.5A+2}{4-0.5B}$, $\quad -8+B = 0.5A+2$, $\quad B-0.5A=-6$

$-\frac{1}{3} = \frac{-2A+2}{4-2B}$, $\quad -4+2B = -6A+2$, $\quad 2B+6A=6$

where A and B are non zero constants.

a) If $u_2 = -2$ and $u_3 = -\frac{1}{3}$, find the value of A and the value of B. **(6)**

b) Show clearly that

$$\sum_{r=1}^{37} u_r = -16. \qquad \textbf{(5)}$$

NC

(A) $b - 0.5a = -6$

(B) $2b + 6a = 6$

(2A) $2b - a = -12$

$7a = 18$

$a = \frac{18}{7}$

$b - \frac{a}{2} = -6$

$b - \frac{9}{7} = -6$

$b = -6 + 1 + \frac{2}{7}$

$= -4\frac{5}{7}$

$\boxed{A = \frac{18}{7} \quad B = -\frac{33}{7}}$

Question 10

A quadratic curve has equation

$$f(x) = (x-1)(x-a),$$

where a is a constant.

Show, **without** a calculus method, that the coordinates of the minimum point of the curve are

$$\left(\frac{a+1}{2}, -\frac{(a-1)^2}{4}\right). \qquad \textbf{(5)}$$

Quadratic, so minimum x between roots $= \frac{a+1}{2}$

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