IYGB GCE

Core Mathematics C1

Advanced Subsidiary

Practice Paper Z

Difficulty Rating: 4.0267/2.0270

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.

A $C + 0.5k = -1$
B $C + 2k = -16$
$-1.5k = 15$
$k = -10$

Question 1

A cubic curve C passes through the points $\boxed{P(-1,-9) \text{ and } Q(2,6)}$ and its gradient function is given by

$C + 0.5k = -1$
$C - 5 = -1$
$C = 4$

$$\frac{dy}{dx} = 3x^2 + kx + 7,$$

$y = x^3 + \frac{k}{2}x^2 + 7x + C$

$P: -9 = -1 + \frac{k}{2} - 7 + C$
$-9 = -8 + \frac{k}{2} + C$
$C + 0.5k = -1$

$Q: 6 = 8 + 2k + 14 + C$
$6 = 22 + 2k + C$
$C + 2k = -16$

where k is a non zero constant.

Find an equation for C. **(8)**

$\boxed{y = x^3 - 5x^2 + 7x + 4}$ ✓

Question 2

The straight line l passes through the points $A(6,0)$ and $B(10,8)$.

$m = \frac{dy}{dx} = \frac{8-0}{10-6} = \frac{8}{4} = 2$
$y - y_1 = m(x - x_1)$
$y - 6 = 2x$

a) Find an equation for l, giving the answer in the form $y = mx + c$, where m and c are constants. **(3)**

$y = 2x + c$
-12

The midpoint of OA is M and the midpoint of OB is N, where O is the origin.

$M = \left(\frac{6+0}{2}, \frac{0+0}{2}\right) = (3,0)$ ✓

b) State the coordinates of M and N. **(2)**

$N = \left(\frac{10+0}{2}, \frac{8+0}{2}\right) = (5,4)$ ✓

c) Determine the area of the trapezium $ABNM$. **(3)**

$A = \frac{a+b}{2}h = 3 \times \frac{\sqrt{(10-6)^2+8^2} + \sqrt{(5-3)^2+4^2}}{2}$
$= 3 \times \frac{\sqrt{80}+\sqrt{20}}{2}$
$= 9\sqrt{5}$

$\frac{1}{2} \times 6 \times 8, \frac{1}{2} \times 3 \times 4, = 18.$ 0 o'day, 2 tris

Question 3

$$p = \frac{3}{2},\ q = \frac{9-\sqrt{17}}{4} \quad \text{and} \quad r = \frac{9+\sqrt{17}}{4}.$$

$p = \frac{6}{4}$

$\frac{6}{4} + \frac{9-\sqrt{17}}{4} + \frac{9+\sqrt{17}}{4} = \frac{6(9-\sqrt{17})(9+\sqrt{17})}{4^3}$

$\frac{6+18}{4} = \frac{6(81-17)}{64}$

$\frac{24}{4} = \frac{6(64)}{64}$, $6 = 6$

Prove that

$$p + q + r = pqr.$$

(5)

Question 4

$$100^x - 10001\left(10^{x-1}\right) + 100 = 0\,.$$

$= (10^x)^2 - 10001\left(\frac{10^x}{10}\right) + 100 = y^2 - \frac{10001}{10}y + 100 = 10y^2 - 10001y + 1000$

a) Show that the substitution $y = 10^x$ transforms the above indicial equation into the quadratic equation

$$10y^2 - 10001y + 1000 = 0\,.$$ **(4)**

$= (10y - 1)(y - 1000) \quad y = 0.1, 1000$

b) Solve the quadratic equation and hence find the two solutions of the **indicial** equation **(4)**

$10^x = 0.1, 1000$

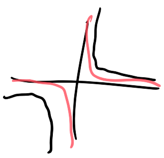
$\boxed{x = -1, 3}$

Question 5

$$y = \frac{2}{x},\ x \in \mathbb{R},\ x \neq 0\,.$$

a) Describe mathematically the transformation that maps the graph of $y = \frac{1}{x}$ onto the graph of $y = \frac{2}{x}$. Stretch vertically by a factor of 2 **(2)**

b) Sketch the graph of $y = \frac{2}{x}$. **(~~3~~)** 2



Write down the equations of the asymptotes of the curve.

$y = 0 \quad x = 0$

The straight line with equation $y = k - 2x$, where k is a constant, is a tangent to the curve with equation $y = \frac{2}{x}$.

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

$\frac{dy}{dx} = -2$

$-2 = -2x^{-2}$

$x^{-2} = 1, -1$

$y = \frac{2}{x} = \frac{2}{1}, \frac{2}{-1} = 2, -2$

c) Determine the possible values of k. **(6)**

$y = k - 2x$

$2 = k - 2 \qquad -2 = k + 2$

$k = 4 \qquad k = -4$

$k = 4, -4$ // √ or ±4

Question 6

$1+p+10 = 1+q, \quad p-q = -10$

$16+4p+10 = 4+q, \quad 4p-q = -22$

A $p-q=-10$

B $4p-q=-22$

$-3p = 12$

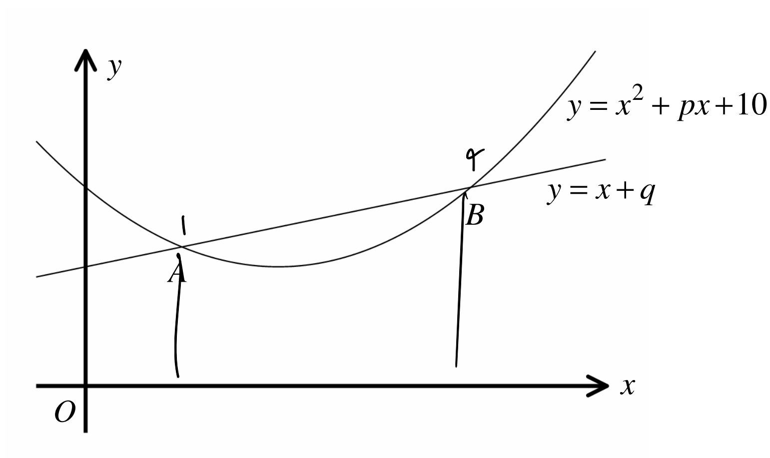
$p=-4$

$p-q=-10$

$-4-q=-10$

$q = 10-4$

$= 6$



The figure above shows the graph of the curve with equation

$$y = x^2 + px + 10$$

and the straight line with equation

$$y = x + q,$$

$y = x+6$

$x=4$, $y=10$ $\quad$ $x=1$, $y=7$

where p and q are constants.

The curve and the straight line intersect at the points A and B whose x coordinates are 1 and 4, respectively.

a) Determine the value of p and the value of q. $p=-4$, $q=6$ ✓ **(6)**

b) Find the coordinates of A and B. $(4,10)$ $(1,7)$ ✓ but say $A=$, $B=$ **(2)**

Question 7

A sequence u_1, u_2, u_3, u_4, … is given by

NC geometric sequences

$$u_n = 2^n + 4n.$$

Find an expression for u_{n+1} as a recurrence relation of the form

$$u_{n+1} = Au_n + Bn + C, \quad u_1 = D,$$

where A, B, C and D are constants to be found. **(5)**

Question 8

The volume, V cm^3, of a soap bubble is modelled by the formula

$$V = (p - qt)^2, \quad t \geq 0, \quad = p^2 - 2pqt + q^2t^2, \quad \frac{dV}{dt} = 2q^2t - 2pq$$

where p and q are positive constants, and t is the time in seconds, measured after a certain instant.

When $t = 1$ the volume of a soap bubble is 9 cm^3 and at that instant its volume is decreasing at the rate of 6 cm^3 per second.

??? NC quadratic simutaneous

Determine the value of p and the value of q. **(10)**

$9 = p^2 - 2pq + q^2$

$\cancel{9 = p(p-2q) + q^2}$

$\cancel{p = \frac{9-q^2}{p-2q}}$

$\cancel{6 = 2q^2t - 2pq}$

$\cancel{6 = 2q^2t - 2\frac{q^2 - q^3}{p-2q}}$

???

$p - q = \pm 3$

$-6 = -2pq + 2q^2$

$(p-q)q = 3$

$q = 1 \quad p = 4$

$\cancel{q = -1} \quad \cancel{p = -4}$

Question 9

Consider the arithmetic progression ??? NC

$$t + 2t + 3t + 4t + \dots + 50,$$

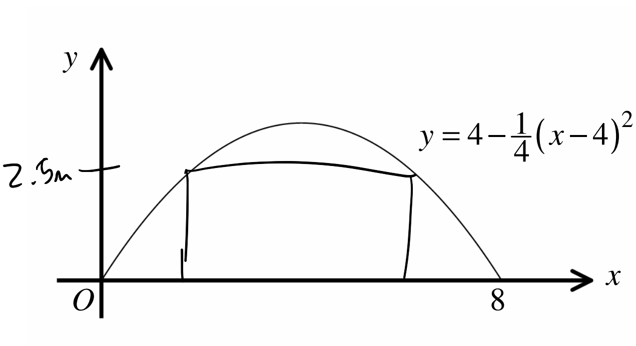
where t is a factor of 50.

Show clearly that the sum of the terms of this progression is

$$25 + \frac{1250}{t}. \qquad (7)$$

$2.5 = 4 - \frac{1}{4}(x-4)^2$

Question 10



$= 4 - \frac{x^2 - 8x + 16}{4}$

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

$= -\frac{1}{4}x^2 + 2x$ ✓

The figure above shows the cross section of a tunnel modelled by the parabolic arc with equation

$$y = 4 - \frac{1}{4}(x-4)^2, \quad 0 \le x \le 8.$$ +2.5 to y int, find roots, difference

A wide lorry load whose cross section is modelled as a rectangle of height 2.5 metres can just pass through this tunnel.

Given that 1 unit on the graph represents 1 metre, determine the width of the lorry load, giving the answer in exact surd form. $= 4 + 2\sqrt{6}$ **(5)**

-2.5

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

$0 = x^2 + 8x + 10$ -10 etc.

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-8 \pm \sqrt{64 - 4 \times 10}}{2} = \frac{-8 \pm \sqrt{24}}{2} = \frac{-8 \pm 2\sqrt{6}}{2}$

$= -4 \pm \sqrt{6}$

$w = -4 + \sqrt{6} - (-4 - \sqrt{6})$

$= -4 + \sqrt{6} + 4 + \sqrt{6}$

$= 4 + 2\sqrt{6}$