IYGB GCE

Core Mathematics C2

Advanced Subsidiary

Practice Paper R

Difficulty Rating: 3.7000/1.7391

Time: 1 hour 30 minutes

Candidates may use any calculator allowed by the Regulations of the Joint Council for Qualifications.

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 8 questions in this question paper.
The total mark for this paper is 75.

Advice to Candidates

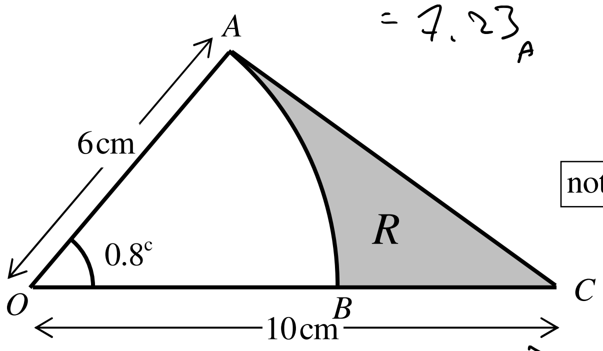
You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.
Non exact answers should be given to an appropriate degree of accuracy.
The examiner may refuse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

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

$AC = \sqrt{10^2 + 6^2 - 2 \times 10 \times 6 \times \cos 0.8}$

$= 7.23_A$

Question 1



not drawn accurately

$10 - 6 = 4$

The figure above shows a triangle OAC where $|OA| = 6$ cm, $|OC| = 10$ cm.

The angle AOC is 0.8 radians.

$A = \frac{1}{2}ab\sin C = \frac{1}{2} \times 6 \times 10 \times \sin 0.8$

a) Calculate the area of the triangle OAC. $= 21.5\text{ cm}^2$ **(2)**

An arc centred at O with radius 6 cm is drawn inside the triangle, meeting OC at B.

The shaded region R is bounded by AC, OC and the arc AB.

$A_A = \frac{1}{2}r^2\theta = \frac{1}{2} \times 36 \times 0.8 = 14.4\text{ cm}^2$

b) Find the area of R. $= 21.5 - 14.4 = 7.1\text{ cm}^2$ **(3)**

c) Determine the perimeter of R. $= 4 + 4.8 + 7.23 = 16.0$ cm **(4)**

$AB = \theta r = 0.8 \times 6 = 4.8$

Question 2

2	2	2p+5	5p-4	-4p-4
		4	4p+18	18p+28
	2	2p+9	9p+14	14p+24

$$f(x) \equiv (x+p)\left(2x^2+5x-4\right)-4,$$

$= 2x^3 + 2px^2 + 5x^2 + 5px - 4x - 4p - 4$

where p is a non zero constant. $= 2x^3 + (2p+5)x^2 + (5p-4)x - 4p - 4$

a) State the value of the remainder when $f(x)$ is divided by $(x+p)$. **(1)**

-4

When $f(x)$ is divided by $(x-2)$ the remainder is 10.

b) Determine the value of p. **(3)**

$14p + 24 = 10$

$14p = -14$

$p = -1$

c) Factorize $f(x)$ into three linear factors. **(4)**

$= 2x^3 + 3x^2 - 9x = x(2x^2+3x-9)$

$= x(2x-3)(x+3)$

Question 3

a) Find the first four terms, in ascending powers of x, of the binomial expansion of $\left(1+\frac{x}{2}\right)^7$, giving each coefficient in exact simplified form. **(3)**

$= \binom{7}{7}1^7 + \binom{7}{6}1^6\left(\frac{x}{2}\right)^1 + \binom{7}{5}1^5\left(\frac{x}{2}\right)^2 + \binom{7}{4}1^4\left(\frac{x}{2}\right)^3 = 1 + \frac{7}{2}x + \frac{21}{4}x^2 + \frac{35}{8}x^3$

b) Hence determine the coefficient of x in the expansion of

$$\left(1+\frac{2}{x}\right)^2\left(1+\frac{x}{2}\right)^7.$$??? **(3)**

Question 4

The sum to infinity of a geometric series is 675 and its second term is 27 times larger than its fifth term.

Find the value of the first term of the series. NC GS **(6)**

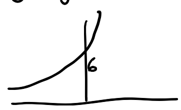
Question 5

$$y = 3 \times 2^x.$$

a) Describe the geometric transformation which maps the graph of the curve with equation $y = 2^x$, onto the graph of the curve with equation $y = 3 \times 2^x$. **(2)**

Stretch vertically by a factor of 3

b) Sketch the graph of $y = 3 \times 2^x$. **(2)**



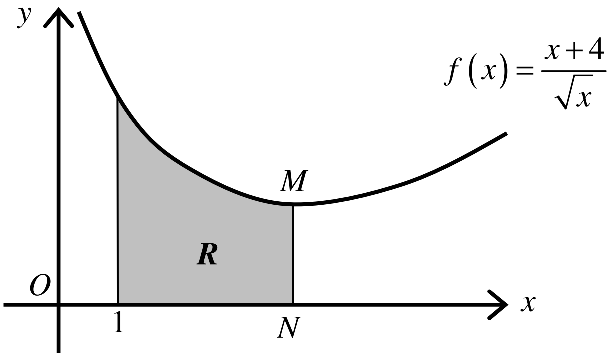
The curve with equation $y = 2^{-x}$ intersects the curve with equation $y = 3 \times 2^x$ at the point P.

c) Determine, correct to 3 decimal places, the x coordinate of P. **(5)**

$2^{-x} = 3 \times 2^{x}$

???

Question 6



The figure above shows the curve C with equation

$$f(x) = \frac{x+4}{\sqrt{x}}, \ x > 0.$$

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

$\frac{dy}{dx} = \frac{1}{2}x^{-\frac{1}{2}} + -2x^{-\frac{3}{2}}$ $\frac{1}{2}x^{-\frac{1}{2}} - 2x^{-\frac{3}{2}} = 0$

a) Determine the coordinates of the minimum point of C, labelled as M. **(7)**

$y = \frac{x+4}{\sqrt{x}} = \frac{8}{2} = 4$ $= 4, 4$

$\frac{1}{\sqrt{x}} = \frac{4}{\sqrt{x^3}}$
$\frac{1}{x} = \frac{16}{x^3}$
$x = \frac{1}{16}x^3$
$1 = \frac{1}{16}x^2$
$16 = x^2$
$x = 4$

The point N lies on the x axis so that MN is parallel to the y axis. The finite region R is bounded by C, the x axis, the straight line segment MN and the straight line with equation $x = 1$.

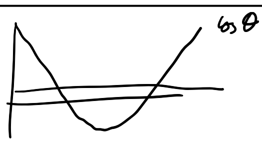
b) Use the trapezium rule with 4 strips of equal width to estimate the area of R. **(4)**

c) Use integration to find the exact area of R. **(5)**

NC

d) Calculate the percentage error in using the trapezium rule to find the area of R. **(2)**

e) Explain with the aid of a diagram why the trapezium rule overestimates the area of R. **(1)**



$\tan = \frac{\sin}{\cos}$

Question 7

Solve the following trigonometric equation in the range given.

$$4\tan^2\theta\cos\theta = 15, \ 0 \le \theta < 360°. \quad \textbf{(8)}$$

$4\tan^2\cos = 15$
$4\frac{\sin^2}{\cos^2}\cos = 15$
$4\frac{\sin^2}{\cos} = 15$
$4\sin^2 = 15\cos$

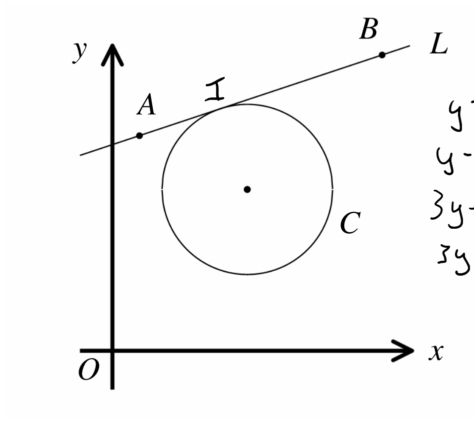
$4(\cos^2 - 1) = 15\cos$
$4\cos^2 - 15\cos - 4 = 0$
let $y = \cos$
$4y^2 - 15y - 4 = 0$

$(y-4)(4y+1) = 0$
$\cos\theta = 4$ ×
$\cos\theta = -0.25$
$\theta = 104.4$
$\theta = 360 - \theta = 255.5$

$= 104.4°$
$= 255.5°$

Question 8

$m = \frac{dy}{dx} = \frac{11-8}{10-1} = \frac{3}{9} = \frac{1}{3}$. $m_n = -3$



TAN	NORM
$y - y_1 = m(x - x_1)$	$y - y_1 = m(x - x_1)$
$y - 8 = \frac{1}{3}(x-1)$	$y - 6 = -3(x-5)$
$3y - 24 = x - 1$	$y - 6 = -3x + 15$
$3y - x = 23$	$y + 3x = 21$

(A) $3y - x = 23$
(B) $y + 3x = 21$
(3,A) $9y - 3x = 69$
$10y = 90$

$y = 9$, $x = 3y - 23 = 27 - 23 = 4$

The figure above shows a circle C centred at the point with coordinates $(5,6)$, and the straight line L which passes though the points $A(1,8)$ and $B(10,11)$.

Given that L is a tangent to C, determine the radius of C. **(10)**

[*You **may not** use a standard formula which finds the shortest distance of a point from a line*]

$I = (4, 9)$

$r = \sqrt{(9-6)^2 + (5-4)^2} = \sqrt{3^2 + 1^2}$
$= \sqrt{10}$