SEKOLAH BUKIT SION

IGCSE Mock Examination 2021

STUDENT NAME			
EXAMINEE NUMBER		CENTRE NUMBER	

0606 ADDITIONAL MATHEMATICS (PAPER 1)

Year 10

10 April 2021

1 hour 30 minutes

Additional Materials:

- Scientific Calculator
- Ruler

READ THESE INSTRUCTIONS FIRST

Write your name, exam number and grade on all the work you hand in.
Write in dark blue or black pen.
Use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 60.

Score :

1 Find the values of m for which the line $y = mx - 5$ is a tangent to the curve $y = x^2 + 3x + 4$. [5]

$x^2+3x+4 = mx-5$

$x^2+(3-m)x+9=0$

$b^2-4ac=0$

$(3-m)^2-4(1)(9)=0$

$9-6m+m^2-36=0$

$m^2-6m-27=0$

$(m-9)(m+3)=0$

$m=9$ or $m=-3$

2 **(a)** Express $5x^2 - 15x + 1$ in the form of $p(x+q)^2 + r$, where p, q and r are constants. [3]

$5(x^2-3x+\_\ )+1$

$5(x^2-3x+(\frac{3}{2})^2)+1-5(\frac{3}{2})^2$

$5(x-\frac{3}{2})^2-\frac{41}{4}$

(b) Hence, state the least value of $5x^2 - 15x + 1$ and the value of x at which this occurs. [2]

Vertex : $(\frac{3}{2}, -\frac{41}{4})$

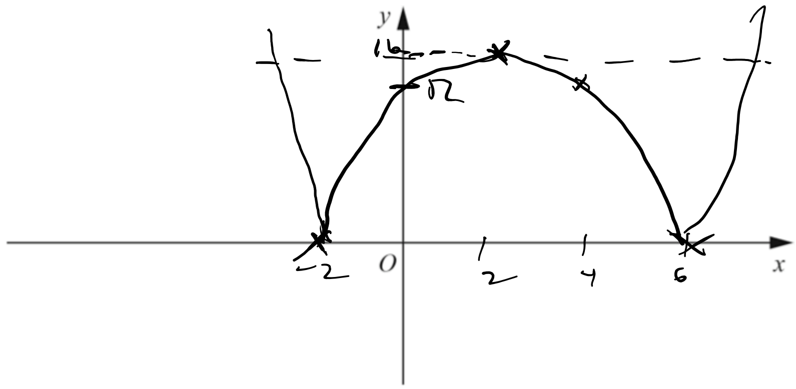
Least value : $-\frac{41}{4}$

when $x=\frac{3}{2}$

$(x-6)(x+2)=0$

$x=6, -2$

3 **(a)** On the axes below, sketch the graph of $y = |x^2 - 4x - 12|$ showing the coordinates of the points where the graph meets the axes. [3]



$(2-6)(2+2)$

$(-4)(4) = -16$

(b) Find the values of k such that the equation $|x^2 - 4x - 12| = k$ has only 2 solutions. [2]

$k = 0, \quad k > 16$

4 Write $\dfrac{y \times (4x^3)^2}{\sqrt{8y^3}}$ in the form $2^a \times x^b \times y^c$, where a, b and c are constants. [3]

$$\frac{y \cdot 16x^6}{8^{1/2} y^{3/2}} = \frac{2^4 \cdot x^6 \cdot y}{2^{3/2} \cdot y^{3/2}}$$

$$= 2^{5/2} x^6 y^{-\frac{1}{2}}$$

5 It is given that $y = \frac{4x^2+1}{2x-3}$.

(a) Find $\frac{dy}{dx}$. [3]

$$\frac{dy}{dx} = \frac{(2x-3)(8x) - (4x^2+1)(2)}{(2x-3)^2}$$

$$= \frac{16x^2 - 24x - 8x^2 - 2}{(2x-3)^2}$$

$$= \frac{8x^2 - 24x - 2}{(2x-3)^2}$$

$$= \frac{2(4x^2 - 12x - 1)}{(2x-3)^2} \quad \#$$

(b) Find the approximate change in y as x changes from 2 to 2.05. [2]

@ $x = 2$, $\frac{dy}{dx} = -18$ ✓ $\quad \delta x = 0.05$

$$\frac{\delta y}{\delta x} = \frac{dy}{dx}$$

$$\delta y = \frac{dy}{dx} \times \delta x$$

$$= -18 \times 0.05$$

$$\delta y = -0.9 \quad ✓$$

6 **(a)** Given that $x - 2$ is a factor of $ax^3 - 12x^2 + 5x + 6$, use the factor theorem to show that $a = 4$. [2]

If $x=2$, $a(2)^3 - 12(2)^2 + 5(2) + 6 = 0$

$8a - 48 + 16 = 0$

$8a - 32 = 0$

$8a = 32$

$a = 4$ Shown

(b) Showing all your working, factorise $4x^3 - 12x^2 + 5x + 6$.
Hence solve $4x^3 - 12x^2 + 5x + 6 = 0$. [4]

$$\begin{array}{r|rrrr} 2 & 4 & -12 & 5 & 6 \\ & & 8 & -8 & -6 \\ \hline & 4 & -4 & -3 & 0 \end{array}$$

$4x^2 - 4x - 3 = 0$

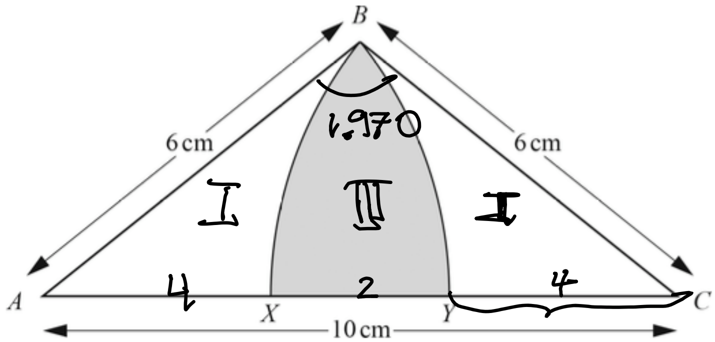
$(2x+1)(2x-3) = 0$

$x = -\frac{1}{2}$ $x = \frac{3}{2}$

$x = 2$

A2

7 The diagram shows an isosceles triangle ABC such that $AC = 10$ cm and $AB = BC = 6$ cm. BX is an arc of a circle, centre C, and BY is an arc of a circle, centre A.



$\mathrm{I} + \mathrm{III} + \mathrm{I} = 16.5856$

$\mathrm{III} = 16.58558 - 2 \times \mathrm{I}$

Given that angle $ABC = 1.970$ radians, correct to 3 decimal places.

(a) Find the perimeter the shaded region. [4]

$\angle A = \angle C = \dfrac{\pi - 1.97}{2} = 0.585796$

$\overset{\frown}{BY} = 0.585796\ (6) = .514778$

$\times\ 2$

$= 7.029556$

$+2$

9.03 cm

(b) Find the area of shaded region. [3]

$A_\Delta = \frac{1}{2} \times 6 \times 10 \times \sin 0.585796$

$A_\Delta = 16.58558$

$A_{\text{sector } ABX} = \dfrac{0.585796}{2\cancel{\pi}} \times \cancel{\pi} \times 6^2$

$= 10.544328$

A of $\mathrm{I} = 16.585585 - 10.544308 = 6.041257$

$A_{\text{shaded}} = 16.585585 - 2 \times 6.041257$

$= 4.50$

8 A solid cylinder has a base radius of r cm and a height of h cm.
The cylinder has a volume of 1200π cm^3 and a total surface area of S cm^2.0

(a) Show that $S = 2\pi r^2 + \frac{2400\pi}{r}$. [3]

$$V = 1200\pi = \pi r^2 h$$
$$\frac{1200\cancel{\pi}}{\cancel{\pi} r^2} = h$$

$$S = 2\pi r^2 + 2\pi r h$$
$$= 2\pi r^2 + 2\pi \cancel{r}\left(\frac{1200}{r^{\cancel{2}}}\right)$$
$$S = 2\pi r^2 + \frac{2400\pi}{r}$$

Shown

(b) Given that h and r can vary, find the stationary value of S and determine its nature. [5]

$$\frac{dS}{r} = 4\pi r - \frac{2400\pi}{r^2} = 0$$
$$\frac{4\pi r^3 - 2400\pi}{r^2} = 0$$
$$4\cancel{\pi} r^3 - 2400\cancel{\pi} = 0$$
$$4r^3 = 2400$$
$$r^3 = 600$$
$$r = \sqrt[3]{600}$$

$$S = 1340$$ 3sf

$$S'' = 4\pi + \frac{4800\pi}{r^3}$$
$$S'' = 12\pi > 0$$

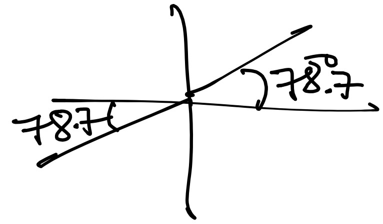
S is minimum

9 **(a)** Find all the angles between 0° and 360° which satisfy the equation

$3(\sin x - \cos x) = 2(\sin x + \cos x)$. [4]

$3\sin x - 3\cos x = 2\sin x + 2\cos x$

$\frac{\sin x}{\cos x} = \frac{5\cos x}{\cos x}$



$\tan x = 5$

$x = \tan^{-1}(5)$

$x = 78.7°$

$x = 258.7°$

(b) Find all the angles between 0 and 3 radians which satisfy the equation

$1 + 3\cos^2 y = 4 \sin y$. [4]

$1 + 3(1 - \sin^2 y) = 4\sin y$

$1 + 3 - 3\sin^2 y = 4\sin y$

$3\sin^2 y + 4\sin y - 4 = 0$

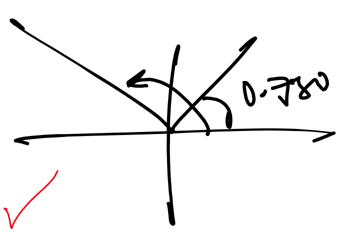
$(3\sin y - 2)(\sin y + 2) = 0$

$\sin y = \frac{2}{3}$ $\quad$ $\cancel{\sin y = -2}$

$y = \sin^{-1}\left(\frac{2}{3}\right)$

$y = 0.729727...$

$y = 0.730$ (3sf), 2.40



10 Solve.

(a) $\log_3(2x+1) = 2 + \log_3(3x-11)$ [4]

$\log_3(2x+1) = 2\log_3 3 + \log_3(3x-11)$

$\log_3(2x+1) = \log_3 9 + \log_3(3x-11)$

$\cancel{\log_3}(2x+1) = \cancel{\log_3} 9(3x-11)$

$2x+1 = 9(3x-11)$

$2x+1 = 27x-99$

$100 = 25x$

$x = 4$

(b) $\log_4 y + \log_2 y = 9$ [4]

$\frac{\log_2 y}{\log_2 4} + \log_2 y = 9$

$\frac{\log_2 y}{2} + \log_2 y = 9$

$\log_2 y + 2\log_2 y = 18$

$3\log_2 y = 18$

$\log_2 y = 6$

$y = 2^6 = 64$