Barker College

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Friday 17th May, 2024
50 minutes
225 copies

Year 11
MATHEMATICS ADVANCED
Assessment Task 2

Topics				
Algebra, Surds and Number	Functions and Graphs	Transformations and Symmetry	Trigonometry	The Coordinate Plane

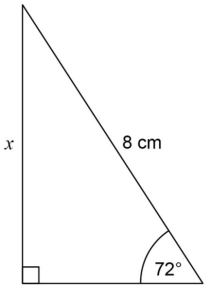
General Instructions

- Answer in the spaces provided.
- Write using blue or black pen. No pencil.
- Show **all necessary working** to gain full marks.
- Marks may not be awarded for careless or poorly arranged working.
- Diagrams are **not to scale**.
- Approved calculators may be used.
- A reference sheet is provided separately.

Sections	Marks
Question 1	/ 11
Question 2	/ 9
Question 3	/ 10
Question 4	/ 12
Question 5	/ 8
Total Marks:	**/ 50**

Question 1 (11 marks)

a. Use trigonometry to work out the length of x. **2**
Round your answer to **2 decimal places.**



b. Solve $5x^2 = 10x + 4$. Give your answers to **2 decimal places**. **2**

c. Simplify $\frac{4p-12p^2}{3} \times \frac{6p}{3p^2-p}$ **2**

d. Let $P(x) = x^3 - 3x^2 - 2x + 1$. Find $P\left(-\frac{1}{2}\right)$ **1**

e. State the **related acute angle** for the following angles:

α) $300°$ **1**

β) $-600°$ **1**

f. Solve $|7x + 15| = 20$ **2**

Question 2 (9 marks)

a. Find the angle of inclination for the graph of $y = 3x + 5$. **1**
Round your answer to **the nearest minute.**

b. State the **domain** of the function $f(x) = \frac{1}{\sqrt{8-x}}$ **1**

c. Determine, **showing all working**, whether the function $f(x) = \frac{3x}{5x^2-1}$ **2**
is even, odd or neither.

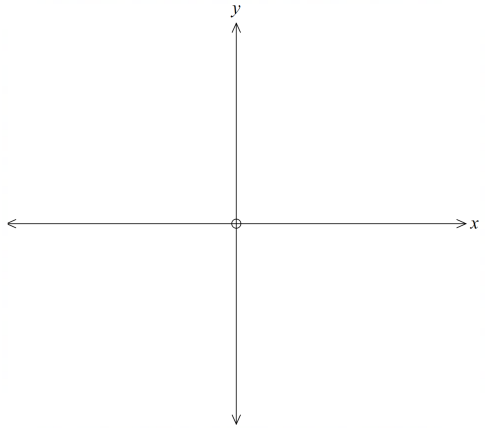
d. Determine the equation, in **general form**, of the line which is perpendicular to the line joining the points $A\ (3,5)$ and $B\ (6,10)$, and passes through the point $C(-3,-1)$. **3**

e. Solve $\cos\theta = \frac{1}{\sqrt{2}}$ for $0° \leq \theta \leq 360°$ **2**

Question 3 (10 marks)

a. Given $f(x) = 5 - x$ and $g(x) = 3x + 7$, **simplify** $f(2x) + g(f(x))$. **2**

b. Sketch the function $y = 2 - 2^{-x}$ on the axes below.
Ensure that you show **all key features.** **3**



c. If $\sin\theta = \frac{\sqrt{7}}{6}$ and $90° < \theta < 180°$, find the **exact value** of $\tan\theta$. **2**

d. Solve $3\tan^2\alpha + 4 = 5$ for $0° \leq \alpha \leq 360°$ **3**

Question 4 (12 marks)

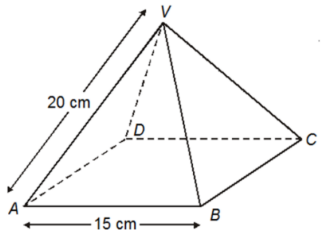
a. A curve has equation $y = 4x^2 + 5x + 3$ **3**
A line has equation $y = x + 2$
Find the **point(s) of intersection** of the line and the curve.
Use an algebraic method.

b. A circle has equation

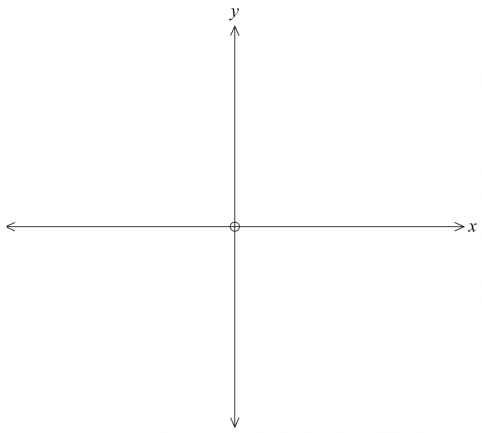
$$x^2 + y^2 - 10x + 16y - 80 = 0$$

Find the coordinates of the **centre** of the circle and the **radius** of the circle. **3**

c. For the right, square-based pyramid below, calculate angle VAC. **3**
Round your answer to the **nearest degree**.



d. Sketch the function $y = -(x+1)^3(x-2)(x-3)^2$ on the axes below. **3**
Ensure that you show ***x*- and *y*-intercepts.**



Question 5 (8 marks)

a. Simplify $\tan x \cos x \operatorname{cosec} x$ **1**

b. Prove $\frac{1-\sin^2 x \cos^2 x}{\sin^2 x} = \cot^2 x + \sin^2 x$ **3**

c. Solve $2\sin^2 x - \cos^2 x - \frac{1}{2}\sin x = \frac{3}{2}$ for $0° \leq x \leq 360°$ **4**

Round your answer(s) to **the nearest degree.**

END OF ASSESSMENT

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1 (a) $\sin(72°) = \frac{x}{8}$

$x = 8\sin(72°)$

$= 7.61$ cm

(b) $5x^2 = 10x + 4$

$5x^2 - 10x - 4 = 0$

$x = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(5)(-4)}}{2(5)}$

$x = 2.34$ or $x = -0.34$

(c) $\frac{4p - 12p^2}{3} \times \frac{6p}{3p^2 - p}$

$= \frac{4p(1-3p)}{3} \times \frac{2 \cancel{6p}}{\cancel{p}(3p-1)}$

$= \frac{-4p\cancel{(3p-1)}}{1} \times \frac{2}{\cancel{3p-1}}$

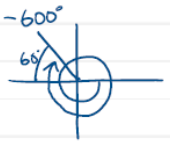
$= -8p$

(d) $P\left(-\frac{1}{2}\right) = \left(-\frac{1}{2}\right)^3 - 3\left(-\frac{1}{2}\right)^2 - 2\left(-\frac{1}{2}\right) + 1$

$= \frac{9}{8}$

(e) (α) 

$60°$

(β) 

$60°$

(f) $|7x + 15| = 20$

$7x + 15 = 20$ or $7x + 15 = -20$

$7x = 5$ $\quad 7x = -35$

$x = \frac{5}{7}$ $\quad x = -5$

2 (a) $y = 3x + 5$ (3 = m)

$m = \tan\theta$

$3 = \tan\theta$

$\theta = \tan^{-1}(3)$

$\theta = 71°34'$

(b) $8 - x > 0$

$8 > x$

$x < 8$

(c) $f(x) = \frac{3x}{5x^2 - 1}$

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

$= \frac{-3x}{5x^2 - 1}$

$-f(x) = -\left(\frac{3x}{5x^2 - 1}\right)$

$= \frac{-3x}{5x^2 - 1}$

$f(-x) = -f(x)$

$\therefore$ ODD

(d) $m_{AB} = \frac{10-5}{6-3}$

$= \frac{5}{3}$

$\perp m_{AB} = -\frac{3}{5}$

$y-(-1) = -\frac{3}{5}(x-(-3))$

$y+1 = -\frac{3}{5}(x+3)$

$5(y+1) = -3(x+3)$

$5y+5 = -3x-9$

$3x+5y+14 = 0$

(e) $\cos^{-1}\left(\frac{1}{\sqrt{2}}\right) = 45°$

$\theta = 45°, 360°-45°$

$\theta = 45°, 315°$

3 (a) $f(2x) = 5-(2x)$

$= 5-2x$

$g(f(x)) = 3(5-x)+7$

$= 15-3x+7$

$= 22-3x$

$f(2x)+g(f(x))$

$= 5-2x+22-3x$

$= 27-5x$

(b) y-int: Sub $x=0$

$y = 2-2^{-(0)}$

$= 1$

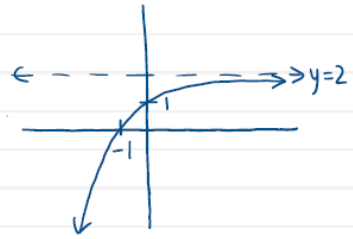
x-int: Sub $y=0$

$0 = 2-2^{-x}$

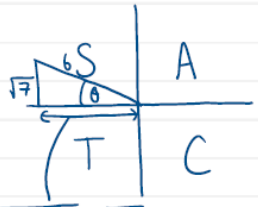
$2^{-x} = 2^1$

$-x = 1$

$x = -1$



(c)



$\sqrt{6^2-(\sqrt{7})^2} = \sqrt{29}$

$\tan\theta = -\frac{\sqrt{7}}{\sqrt{29}}$

(d) $3\tan^2 x + 4 = 5$

$\tan^2 x = \frac{1}{3}$

$\tan x = \pm\sqrt{\frac{1}{3}} = \pm\frac{1}{\sqrt{3}}$

$\tan^{-1}\left(\frac{1}{\sqrt{3}}\right) = 30°$

$x = 30°, 150°, 210°, 330°$

4 (a) $y = 4x^2+5x+3$

$y = x+2$

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

$4x^2+4x+1 = 0$

$(2x+1)^2 = 0$

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

$y = \left(-\frac{1}{2}\right)+2$

$= \frac{3}{2}$

$\therefore \left(-\frac{1}{2}, \frac{3}{2}\right)$

(b) $x^2+y^2-10x+16y-80 = 0$

$x^2-10x+25+y^2+16y+64$

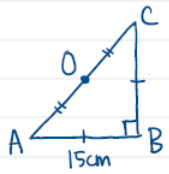
$= 80+25+64$

$(x-5)^2+(y+8)^2 = 169$

Centre $= (5,-8)$

radius $= \sqrt{169} = 13$

(c)



$AC = \sqrt{15^2+15^2}$

$= 15\sqrt{2}$

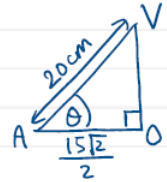
$AO = \frac{15\sqrt{2}}{2}$

$\cos\theta = \frac{\frac{15\sqrt{2}}{2}}{20}$

$= \frac{3\sqrt{2}}{8}$

$\theta = \cos^{-1}\left(\frac{3\sqrt{2}}{8}\right)$

$= 58°$



(d) $y = -(x+1)^3(x-2)(x-3)^2$

y-int: Sub $x=0$

$y = -(0+1)^3(0-2)(0-3)^2$

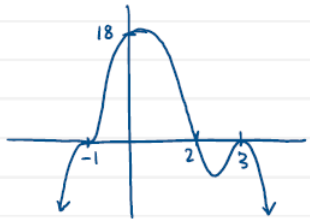
$= 18$

x-int: Sub $y=0$

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

$x = -1, 2, 3$

triple root, single root, double root



5 (a) $\tan x \cos x \operatorname{cosec} x$

$= \frac{\sin x}{\cos x} \times \cos x \times \frac{1}{\sin x}$

$= 1$

(b) (there are multiple methods)

$LHS = \frac{1-\sin^2 x\cos^2 x}{\sin^2 x}$

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

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

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

$= \frac{\cos^2 x}{\sin^2 x} + \sin^2 x$

$= \cot^2 x + \sin^2 x$

$= RHS$

(c) $2\sin^2 x - \cos^2 x - \frac{1}{2}\sin x = \frac{3}{2}$

$2\sin^2 x - (1-\sin^2 x) - \frac{1}{2}\sin x = \frac{3}{2}$

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

$3\sin^2 x - \frac{1}{2}\sin x - \frac{5}{2} = 0$

$6\sin^2 x - \sin x - 5 = 0$

$(6\sin x + 5)(\sin x - 1) = 0$

$6\sin x + 5 = 0$ or $\sin x - 1 = 0$

$\sin x = -\frac{5}{6}$ $\sin x = 1$

$\sin^{-1}\left(\frac{5}{6}\right) = 56^\circ$ $x = 90^\circ$

$x = 180 + 56, 360 - 56$

$x = 236^\circ, 304^\circ$

$\therefore x = 90^\circ, 236^\circ, 304^\circ$