



DAPTO HIGH SCHOOL
2007

YEAR 11
PRELIMINARY EXAMINATION

Mathematics

General Instructions

- * Reading Time – 5 minutes
- * Working Time – 2 hours
- * Total marks – 80
- * All questions are of equal value
- * Attempt all questions
- * Write using a blue or black pen
- * Approved calculators may be used
- * All necessary working should be shown for every question
- * Begin each question on a fresh sheet of paper
- * Write on only one side of the paper

Question 1 (12 Marks)

- (a) Express the decimal $0.\dot{1}\dot{4}$ as a fraction in its simplest form. **1**
- (b) Expand and simplify $2\sqrt{3}(3\sqrt{3} - \sqrt{6})$. **2**
- (c) Express $\frac{2}{5-2\sqrt{5}}$ as a fraction with a rational denominator. **2**
- (d) Factorise the following expressions fully:
- (i) $x^3 - 9xy^2$ **2**
- (ii) $x^2 + xy + xz + yz$ **1**
- (e) Solve simultaneously:
- $$\begin{aligned}x - 4y &= -12 \\ 2x + y &= 3\end{aligned}$$
- 2**
- (f) Solve for x :
- (i) $\frac{2x}{3} - 4 = x + 2$ **1**
- (ii) $x^2 - 3x - 88 = 0$ **1**

Question 2 (12 Marks)

- (a) Show that $f(x) = x^3 - x$ is an odd function. **2**
- (b) Sketch the graphs of the following. State the domain and range for each graph.
- (i) $y = 2^{-x}$ **3**
- (ii) $2x - 3y + 12 = 0$ **3**
- (c) Show the region of the number plane where the following are simultaneously true:
- $$\begin{aligned}(x - 2)^2 + y^2 &\leq 4 \\ y &\leq x - 2 \\ y &\leq 0\end{aligned}$$
- 3**
- (d) Explain why the following relation is a function or not a function:
- (1, 2) (1, 3) (2, 3) (3, 4) **1**

Question 3

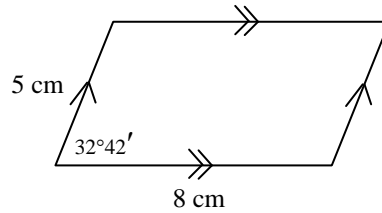
(12 Marks)

- (a) A ship is 35 km due east of a lighthouse.
The lighthouse is 20 km due south of a cliff.

(i) Draw a diagram to show this information. 1

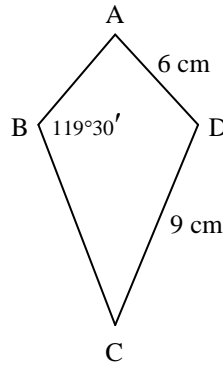
(ii) What is the bearing of the cliff from the ship, to the nearest degree? 2

- (b) A parallelogram has adjacent sides of 5 cm and 8 cm and an included angle of $32^{\circ}42'$.



Find the length of the shorter diagonal (correct to 1 decimal place). 2

- (c) Find the area of the kite ABCD (correct to 2 decimal places). 2



- (d) Find the *exact* value of $\cos 135^{\circ}$. 1

- (e) Write $\tan(90^{\circ} - \theta)$ as a trigonometric ratio in terms of θ . 1

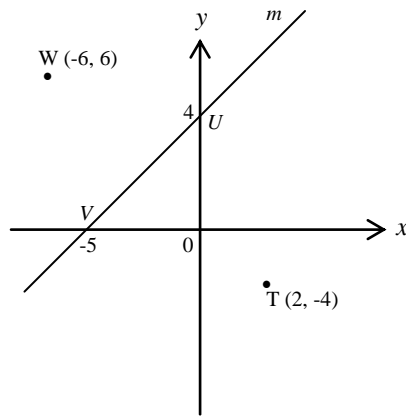
- (f) (i) Show that $\cos\theta \tan\theta = \sin\theta$ 1

- (ii) Hence solve $\cos\theta \tan\theta = -\frac{1}{2}$ for $0^{\circ} \leq \theta \leq 360^{\circ}$ 2

Question 4

(12 Marks)

(a)

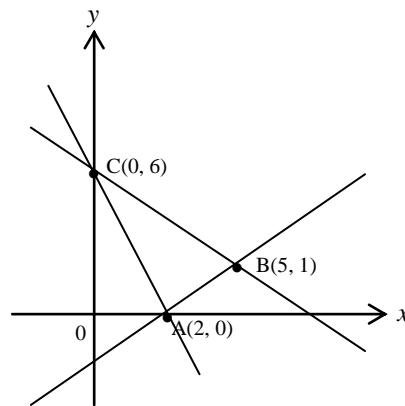


The line m crosses the x -axis at $V(-5, 0)$ and the y -axis at $U(0, -4)$.

The points $T(2, -4)$ and $W(-6, 6)$ are also shown,

- (i) Find the gradient of the line m . 1
- (ii) Show that the equation of the line m is $4x - 5y + 20 = 0$. 1
- (iii) Find the perpendicular distance from the point T to the line m . 2
- (iv) At what angle is the line m inclined to the positive x -axis.
(Answer to the nearest minute). 2

(b)



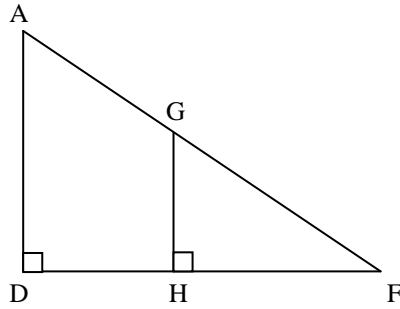
The points $A(2, 0)$, $B(5, 1)$ and $C(0, 6)$ are shown above. D is a point on the line AB .

- (i) Show that the lines AB and AC are perpendicular. 2
- (ii) Show that the length of AB is $\sqrt{10}$ units. 1
- (iii) Find the area of $\triangle ABC$. 2
- (iv) If B is the midpoint of the interval AD , find the coordinates of D . 1

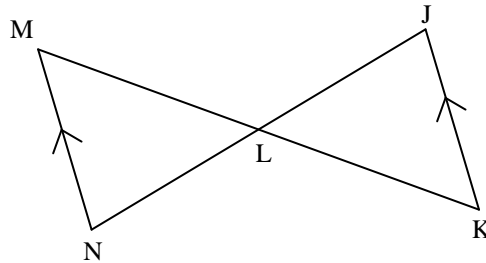
Question 5

(12 Marks)

- (a) In the diagram below, $\angle EDF \parallel \angle GHF = 90^\circ$.



- (i) Show, giving reasons, that $\triangle EDF \parallel \triangle GHF$. 3
- (ii) Given that $ED = 6\text{cm}$, $GH = 4\text{cm}$ and $DH = 4\text{cm}$, find the distance of HF . 1
- (b) In the figure below, $JK \parallel MN$ and $ML = KL$. Prove that $\triangle JKL \equiv \triangle LMN$. 3



- (c) Simplify $\frac{27}{(3^x)^3 + 27^{1-x}}$ 2
- (d) At a nursery, all plants increased in price by 35%. One plant now costs \$82.50.
What was the old price of the plant? 1
- (e) The angles of a triangle are in the ratio 1:2:3. Find the size of the largest angle. 2

Question 6 (12 Marks)

(a) Find the first derivative of the following. Express all answers in simplest surd form.

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

(ii) $y = 4x^{\frac{3}{2}}$ 1

(iii) $y = \frac{x+1}{x^3+2}$ 2

(iv) $y = (1 - 5x^2)^3$ 2

(v) $y = 3x^4(4 - x^3)$ 2

(b) Find $\frac{d^2y}{dx^2}$ for $y = 7x^3 - 6x^2 + 9x + 3$. 2

(c) Find the equation of the tangent to the curve $y = x^4 - 3x^2$ at the point $(-1, -2)$ on it. 2

Question 7 (8 Marks)

(a) A function is defined as:

$$g(x) = \begin{cases} |2x| & \text{for } x < 0 \\ x^2 & \text{for } 0 \leq x \leq 2 \\ 1 & \text{for } x > 2 \end{cases}$$

(i) Find the value of $g\left(1\frac{1}{2}\right)$. 1

(ii) Draw a sketch of the function. 2

(b) Show that $\frac{1}{1 - \sin\theta} + \frac{1}{1 + \sin\theta} = 2\sec^2\theta$. 2

(c) Solve: $|2 - x| < 3$. 2

(d) Find: $\lim_{x \rightarrow 1} \frac{x-1}{x^2-x}$. 1