| | Questions | Reading Time | Working Time | Marks |
|---|---|---|---|---|
| **Calculator Free** | **1 – 4** | **5 minutes** | **15 minutes** | **12** |
| Calculator Assumed | 5 - 8 | 5 minutes | 30 minutes | 24 |
| Total | | | | 36 |

**1.**    [1, 2 marks]

Express in exact rectangular form:

(a)    $e^{i\frac{\pi}{6}}$

(b)    $3e^{2+i\frac{2\pi}{3}}$

**2.**    [2 marks]

Given that $z = 3e^{i\theta}$, determine an expression in exponential form for $iz$.

**3.**    [2, 1, 1 marks]

Given that $w = \sqrt{3} + i$ , express in exact exponential form:
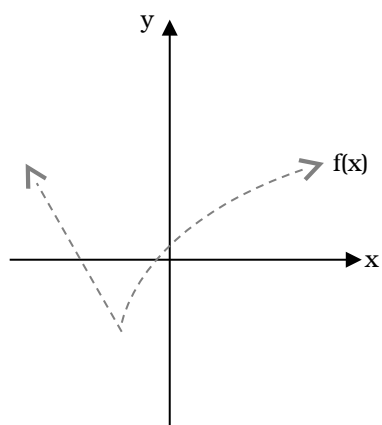
(a)    $w$
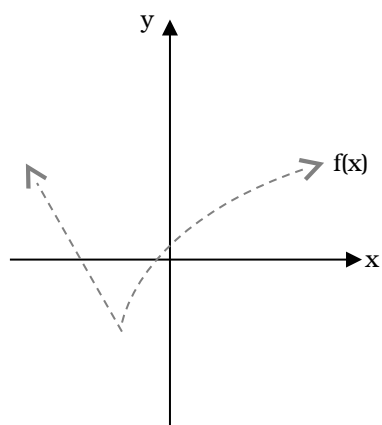
(b)    $\overline{w}$

(c)    $w^3$

**4.** [1, 2 marks]

The sketch of y = f(x) is given below.

Sketch on the same axes the graphs of:

(a)   y = f(|x|)                                  (b)   |y| = f(x)

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**5.**     [2 marks]

Solve for x:          $\sqrt[3]{3+|x|} \leq 2$

**6.**     [1, 1, 2 marks]

(a)     Sketch the graph of f(x) = $|x^2 - 2x - 2|$.
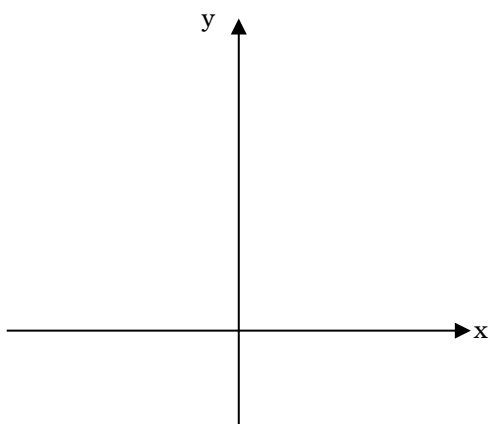


Hence state the value(s) of b such that f(x) = b has exactly

(a)     three solutions

(b)     two solutions

**7.** [1, 4, 5 marks]

Consider the plane $\Pi_1$:   $\mathbf{r} = (3 + 2\mu - \lambda)\mathbf{i} + (5 - 4\mu + 2\lambda)\mathbf{j} + (7 + 3\mu + 3\lambda)\mathbf{k}$.

(a)   Find the equation of the plane containing the point (2, 1, 5) and parallel to $\Pi_1$.

(b)   Determine if the point (13, -9, 4) lies on the plane $\Pi_1$.

(c)   Write $\Pi_1$ in normal form (ie $\mathbf{r \cdot n} = \mathbf{c}$).

**8.** [8 marks]

A sphere centred at (3, 4, -2) and with radius 2 can be defined by the vector equation $|\mathbf{r} - (3\mathbf{i} + 4\mathbf{j} - 2\mathbf{k}| = 2$. Determine the minimum distance the sphere is from the plane defined by $x - y + 2z = 13$.