Year 10 Mathematics
AOS 9 Revision [10.4] Mock CAT 1
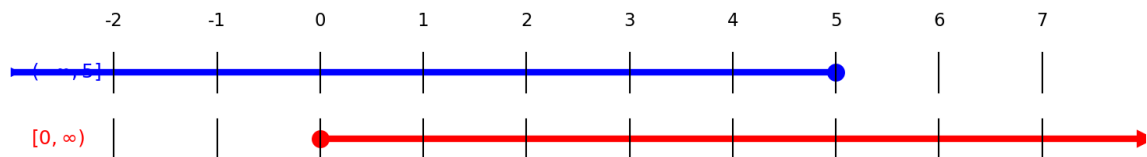## Version B

Instructions: Answer all questions. Show all working.
Total Marks: 50
Time: 60 minutes

Section A: Short Answer Questions (36 Marks)

Question 1 [1 mark]

Write the intersection $(-\infty, 5] \cap [0, \infty)$ in interval notation.
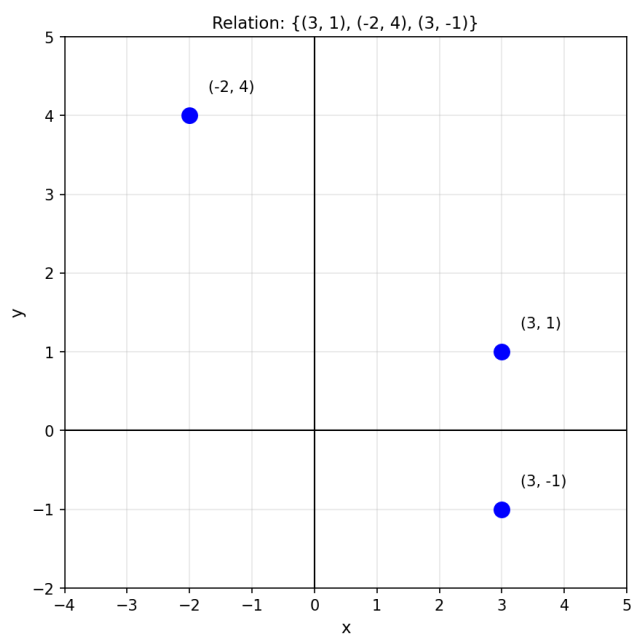

Question 2 [1 mark]

Factorise completely: $16x^2 - 49$.

Question 3 [1 mark]

Does the relation $\{(3, 1), (-2, 4), (3, -1)\}$ define a function? Give a reason.

Relation: {(3, 1), (-2, 4), (3, -1)}

Question 4 [1 mark]

Expand: $(x - 2)(x + 7)$.

Question 5 [1 mark]

For $y = (x + 2)^2 - 5$, find the y-intercept.
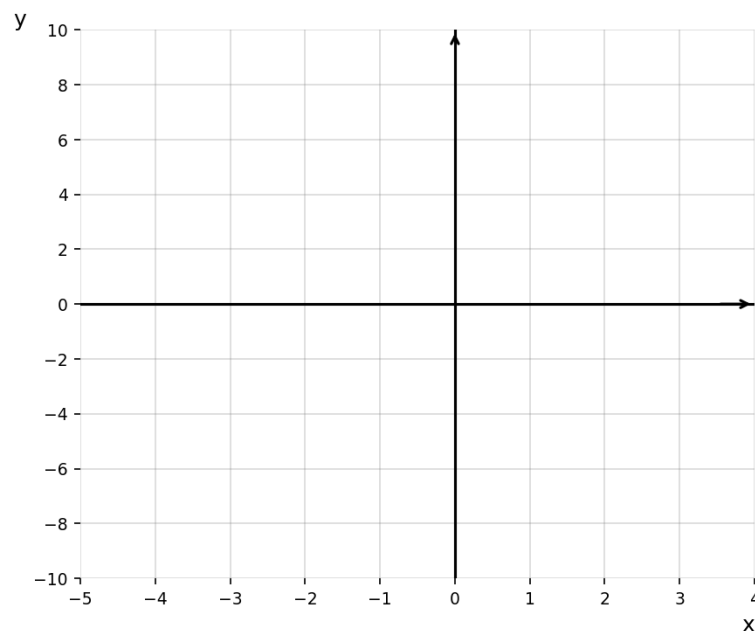
Question 6 [2 marks]

Use long division to find the quotient and remainder when $3x^4 + 2x^3 - 4x + 1$ is divided by $x^2 - 1$.

Question 7 [2 marks]

Solve $x^3 + 2x^2 - 4x - 8 = 0$.

Question 8 [2 marks]

Sketch $y = (x+2)^2(x-2)$. Label all intercepts.
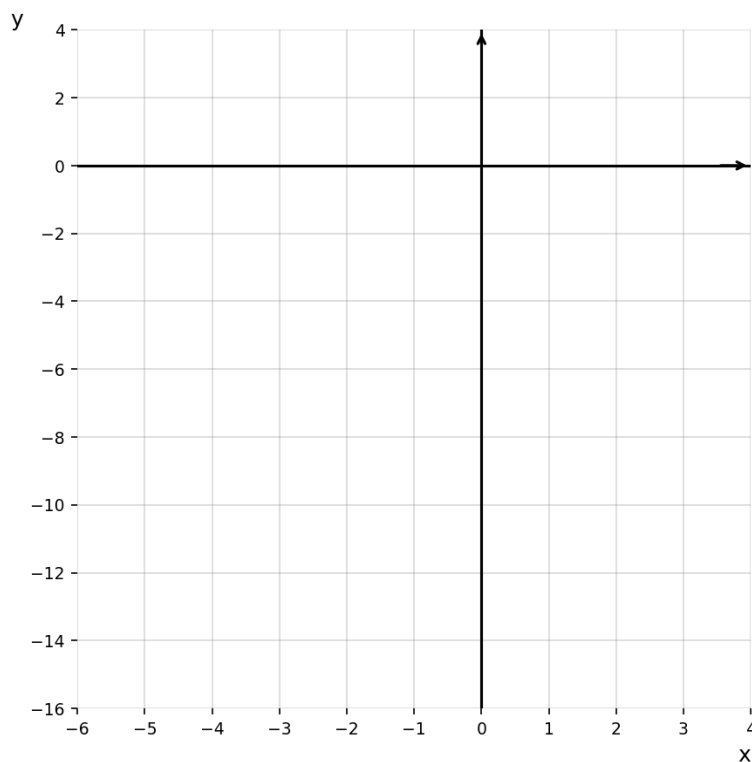
Question 9 [2 marks]

Find the centre and radius of $x^2 + y^2 - 6x + 8y - 11 = 0$.

Question 10 [2 marks]

Let $f(x) = 2x^3 + 5x^2 + x - 2$. Using the Remainder Theorem, find the remainder on division by $x + 1$. Hence, decide if $x + 1$ is a factor.

Question 11 [2 marks]

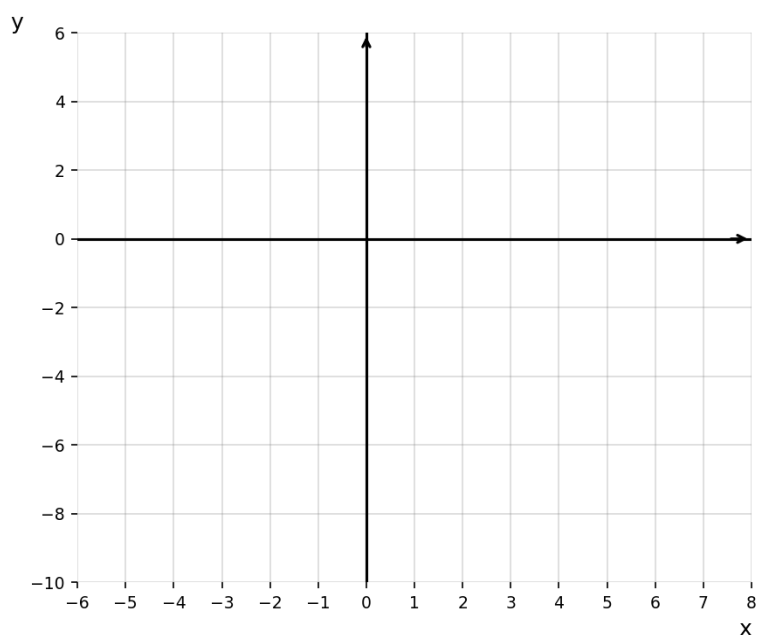Sketch $y = (x - 1)^4 - 2$. Label the turning point and any intercepts.

Question 12 [2 marks]

Find k so that $(x - 2)$ is a factor of $x^3 - kx^2 + x + 6$. Hence, factor the polynomial completely.

Question 13 [2 marks]

Sketch the graph $y = \frac{-3}{x+2} + 1$. Label the asymptotes.

Question 14 [4 marks]

From the platform edge at $x = -2$ m to $x = 7$ m along the deck, the slide height (m) is $h(x) = \sqrt{x + 2} - 3$.

    a. State the domain and range over this section. **(2 marks)**

    b. How far from the edge $(x = -2)$ does the slide first reach -1 m high? **(2 marks)**

Question 15 [4 marks]

A circular spray pattern is $(x + 3)^2 + (y - 2)^2 = 25$ (metres).

    a. State the centre and radius. **(1 mark)**

    b. Is $(1, 5)$ on the boundary? Justify. **(1 mark)**

    c. The sprinkler is moved 4 m right and 1 m down. Write the new equation. **(2 marks)**

Question 16 [3 marks]

A stage light intensity curve is $y = -\frac{1}{2}(x-3)^4 + 2$.

    a. Describe the transformations from $y = x^4$. **(2 marks)**

    b. Identify the turning point and whether the curve opens up or down; justify from your description. **(1 mark)**

Question 17 [4 marks]

A tunnel cross-section is $x^2 + y^2 = 25$ (metres), ground is $y = 0$. A truck travels along the centreline.

    a. Determine the maximum truck width that fits at the height $y = 4$ m. **(2 marks)**

    b. If the truck is 6 m wide, what is the maximum height it can have at the centreline? Give an exact value. **(2 marks)**

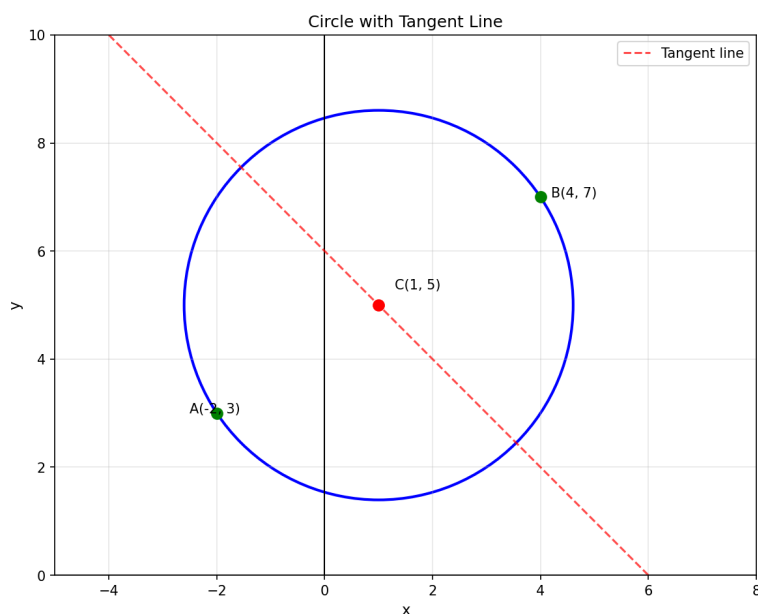# Section B: Extended Response Questions (14 Marks)

Question 18 [14 marks]

The city is finalising Harmony Plaza, a plaza drawn on the Cartesian plane (units in metres).

The outer rim of a round seating area is a circle whose diameter has endpoints $A(-2, 3)$ and $B(4, 7)$.

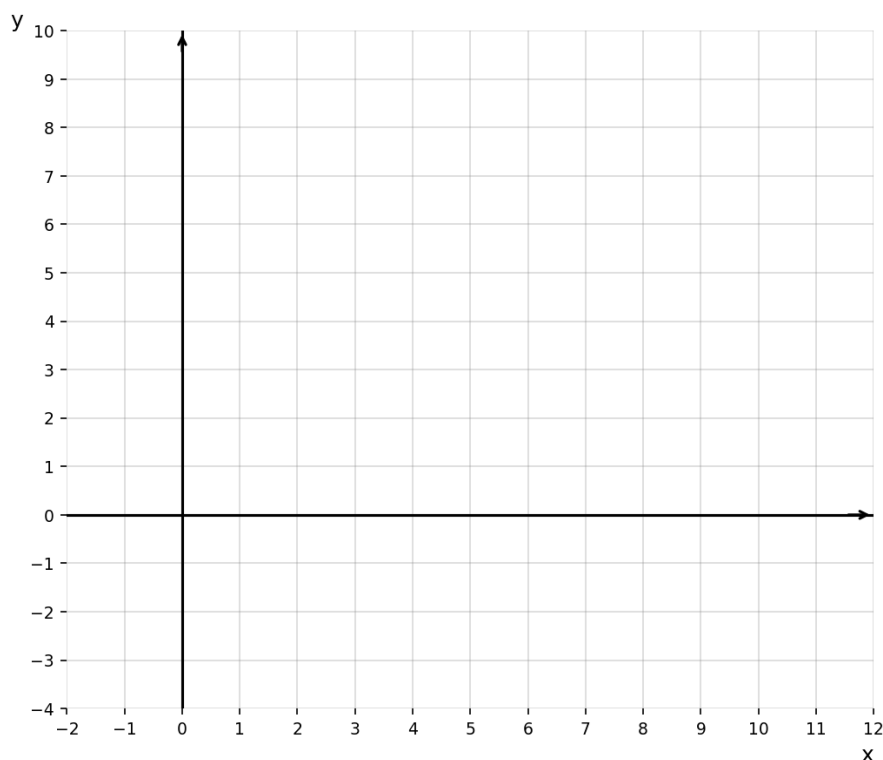**a.** Find the equation of the circle. **(3 marks)**

A family of straight paths is planned with equations $L_k : y = -x + k$.

b. Determine the value(s) of k for which L_k is tangent to the circle. **(3 marks)**

Circle with Tangent Line

c. Hence, determine the equation of the tangent line(s). **(1 mark)**

d. Tech-Active. Sketch the graph of the circle and a line L_k for the k found in **part b**. Label the point of intersection, correct to two decimal places. **(3 marks)**

A raised planter's front edge is modelled by the cubic:

$$G(x) = x^3 - 5x^2 + 2x + 8$$

e.

    i. Use the Factor Theorem to show that $(x - 2)$ is a factor of $G(x)$. **(1 mark)**

    ii. Perform polynomial division to factorise $G(x)$ completely, and use the Null Factor Law to find all x-intercepts. **(3 marks)**