Year 11 Mathematics Extension 1

Topic: Polynomials (1 of 4)
Review Questions: Language and Graphs of Polynomials
Term 3, 2026

How to use this review set

These are real past-paper questions, grouped by question pattern. The grey label on each question shows where it is from and its marks.

- The questions are grouped by the pattern that keeps coming up in exams, a few of each in a row, running from the plainer patterns into the harder ones near the end. Work through them and you will meet every type an exam can throw at you.
- This set **is your diagnostic**. Working through it shows you exactly which patterns are solid and which need work. Attempt every question properly in your own book, and go back to your notes to help you work through tough questions if needed.
- Every question you get wrong, need help with or struggle with goes in your **Mistakes Log**, which you should be working on daily to get you exam-ready.

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Language and properties of polynomials

1. Polynomial language: degree, leading and constant term, monic
2. Zeroes, roots and multiplicity
3. Repeated (double) roots: finding unknowns and factorising

Graphs of polynomials

4. Sketching a polynomial from its factors
5. Identifying a polynomial from its graph

Language and properties of polynomials

1. Polynomial language: degree, leading and constant term, monic

Q1 2025 Hurlstone Prelim Q8 · **1 mark**

What is the degree and leading coefficient of $f(x) = -x + 5x^2 - 6x^3 + 10$?

(A) degree 1 with a leading coefficient of -1

(B) degree 3 with a leading coefficient of 6

(C) degree 3 with a leading coefficient of -6

(D) degree 6 with a leading coefficient of -1

Q2 2022 St George Girls Prelim Q1 · **1 mark**

Which of the following is not a polynomial?

(A) $2x^3 + x^{-1}$

(B) -17π

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

(D) $\sqrt{3}\,x^4 + x - 14$

Q3 2023 Sydney Grammar Prelim Q2 · **1 mark**

In which polynomial is the constant term greater than the degree?

(A) $3x^2 + x + 2$

(B) $(2x - 3)^3$

(C) $x(5x^2 + 4)$

(D) $(x - 2)^4$

Q4 2022 Baulkham Hills Prelim Q8 · **1 mark**

Consider the polynomial $P(x) = (k^3 - k)x^4 + (k^2 - k)x^3 + x^2$. What value(s) of k will make $P(x)$ a non-zero polynomial of degree 3?

(A) $k = -1$

(B) $k = -1,\ k = 0$

(C) $k = -1,\ k = 1$

(D) $k = -1,\ k = 0,\ k = 1$

Q5 2023 Knox Prelim Q8 · **1 mark**

The polynomial $H(x)$ has degree 5. When $H(x)$ is divided by another polynomial $G(x)$ the remainder is $x^2 - x + 2$. Which of the following is true about the degree of the polynomial $K(x) = H(x)\big(G(x)\big)^2$?

(A) The degree could be $7, 8, 9$ or 10.

(B) The degree could be $11, 13$ or 15.

(C) The degree could be $9, 11, 13$ or 15.

(D) The degree could be $13, 15$ or 17.

2. Zeroes, roots and multiplicity

Q6 2020 Caringbah Prelim Q11(d)(i) · **1 mark**

If $P(x) = x\left(x^2 - 1\right)^2$, find all the roots of $P(x)$.

Q7 2020 Cherrybrook Tech Trial Q3 · **1 mark**

The polynomial $P(x) = x^3 - 12x^2 + 21x + k$ has a double root. What are the possible values of k?

(A) $k = -1$ or $k = -7$

(B) $k = 1$ or $k = 7$

(C) $k = 10$ or $k = -98$

(D) $k = -10$ or $k = 98$

Q8 2023 Presbyterian Prelim Q10 · **1 mark**

The polynomial $P(x)$ has degree 5 and $P(x)$ is an odd function. Which of the following could be true?

I: The sum of the real roots of $P(x)$ is positive.

II: $P(x) = 0$ has one distinct solution.

III: $P(x)$ has a double root.

(A) I and II

(B) II only

(C) II and III

(D) I and III

Q9 2025 Caringbah Prelim Q6(b) · **3 marks**

Consider the polynomial $P(x) = x^3 + 5x^2 + 3x - 9$.

(i) Show that $P(x)$ has a double root at $x = -3$.

(ii) Hence, or otherwise, factorise $P(x)$ completely.

Q10 2024 Girraween Prelim Q7(b) · **3 marks**

Consider the polynomial $p(x) = x^3 - px^2 + qx - pq$, where $q > 0$.

(i) Show that $(x - p)$ is a factor of $p(x)$.

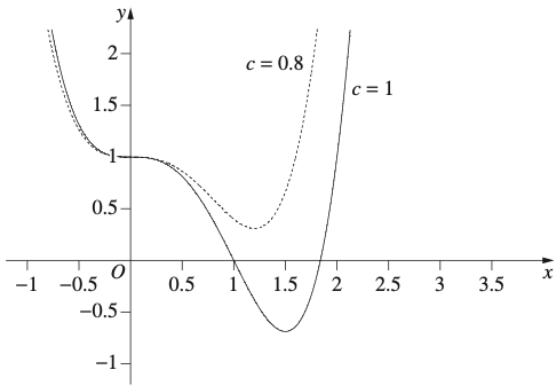
(ii) Show that the equation $p(x) = 0$ has only one real root.

Q11 2023 HSC Q14(b) · **4 marks**

Consider the hyperbola $y = \dfrac{1}{x}$ and the circle $(x - c)^2 + y^2 = c^2$, where c is a constant.

(i) Show that the x-coordinates of any points of intersection of the hyperbola and circle are zeros of the polynomial $P(x) = x^4 - 2cx^3 + 1$.

(ii) The graphs of $y = x^4 - 2cx^3 + 1$ for $c = 0.8$ and $c = 1$ are shown.



By considering the given graphs, or otherwise, find the exact value of $c > 0$ such that the hyperbola $y = \dfrac{1}{x}$ and the circle $(x - c)^2 + y^2 = c^2$ intersect at only one point.

3. Repeated (double) roots: finding unknowns and factorising

Q12 2022 Shore Trial Q3 · **1 mark**

The polynomial $P(x) = x^3 - x^2 - 5x - 3$ has a double root at $x = \alpha$. What is the value of α?

(A) $\alpha = -\dfrac{5}{3}$

(B) $\alpha = -1$

(C) $\alpha = 1$

(D) $\alpha = \dfrac{5}{3}$

Q13 2020 Gosford Prelim Q9(b) · **2 marks**

The equation $P(x) = 0$, where $P(x) = x^3 + cx + d$, has a double root at $x = 1$. Find the values of c and d.

Q14 2023 Abbotsleigh Trial Q11(a) · **3 marks**

The polynomial $P(x) = 8x^4 - 38x^3 + 9x^2 + ax + b$ has a double root at $x = 3$. Find the value of a and b, where a and b are real numbers.

Q15 2022 Sydney Tech Trial Q12(b) · **3 marks**

The polynomial $P(x) = ax^3 + bx^2 + c$ has a double root at $x = 3$ and has remainder -36 when divided by $x + 3$. Find the values of a, b and c.

Q16 2020 Caringbah Prelim Q13(b) · **3 marks**

A polynomial of degree 4 has a double zero at 2, with the other two zeros being k and $-k$. When $x = 1$ it takes the value 8, and when $x = 3$ it takes the value 80. Find the possible values of k.

Q17 2020 St George Girls Prelim Q10(c) · **4 marks**

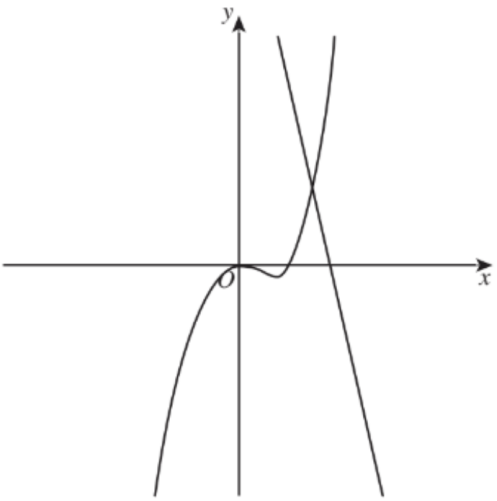
Factorise $P(x) = x^4 + x^3 - 15x^2 - 9x + 54$, given it has a double root. Express your answer in fully factored form.

Graphs of polynomials

4. Sketching a polynomial from its factors

Q18 2021 Riverview Trial Q2(c)(i) · 1 mark

Sketch the graph of $y = 3x^3 - 2x^2$.



Q19 2022 Sydney Girls Trial Q13(a)(i) · 2 marks

Sketch the function $y = f(x)$ where $f(x) = 9x - x^3$.

Q20 2023 Knox Prelim Q11(d)(i) · 2 marks

Sketch the polynomial $y = x(x + 3)(x - 2)^2$.

Q21 2020 Sydney Girls Prelim Q1(b) · 3 marks

(i) Sketch the graph of $y = (x + 4)(x - 3)^2$.
(ii) Hence, or otherwise, solve the inequality $(x + 4)(x - 3)^2 \geq 0$.

Q22 2020 Caringbah Prelim Q12(a) · 3 marks

Sketch the graph of $y = (1 - x)^3(2 + x)^2(3 - x)$, showing all the intercepts.

Q23 2024 Penrith Prelim Q11(b)(iv) · **3 marks**

Consider the polynomial $P(x) = x^3 - x^2 - 33x - 63$. Fully factorise $P(x)$ and sketch the graph of this polynomial, showing all intercepts.

Q24 2023 Sydney Grammar Prelim Q9(d) · **3 marks**

Sketch the polynomial $y = (x+1)^2(x-1)^3(x-3)$, labelling all intercepts with the coordinate axes.

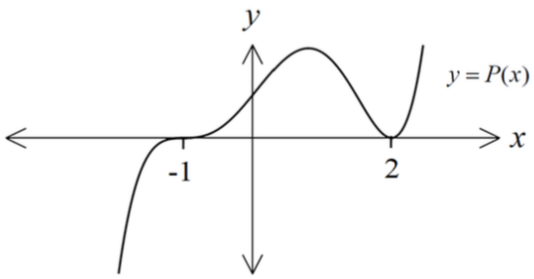
Q25 2023 Penrith Prelim Q12(c) · **5 marks**

Sketch the graph of $y = x^4 - 5x^3 - 3x^2 + 17x - 10$, given that it has a root at $x = 1$ which has multiplicity 2. Label all intercepts on your graph. (Do not use calculus and do not calculate the coordinates of the turning points; sketch them roughly, according to your scale and intercepts.)

5. Identifying a polynomial from its graph

Q26 2022 Abbotsleigh Trial Q2 · **1 mark**

Which of the following could be the equation of the graphed polynomial, $P(x)$?



(A) $P(x) = -(x+1)^3(x-2)^2$

(B) $P(x) = (x-1)^3(x+2)^2$

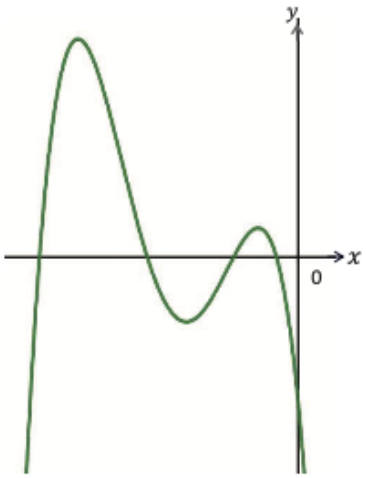
(C) $P(x) = (x+1)^3(x-2)^2$

(D) $P(x) = (x-1)^3(2-x)^2$

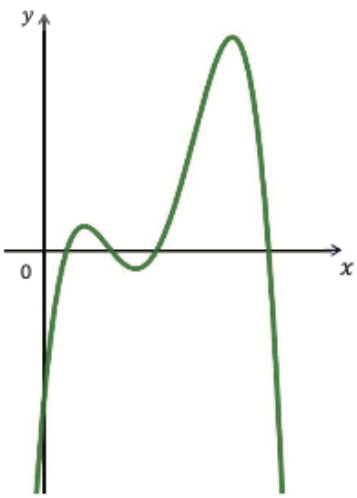
Q27 2024 Knox Trial Q7 · **1 mark**

Consider the polynomial $f(x) = ax^4 + bx^3 + cx + d$, where the constant a is negative and the constant b is positive. Which graph could represent $f(x)$?

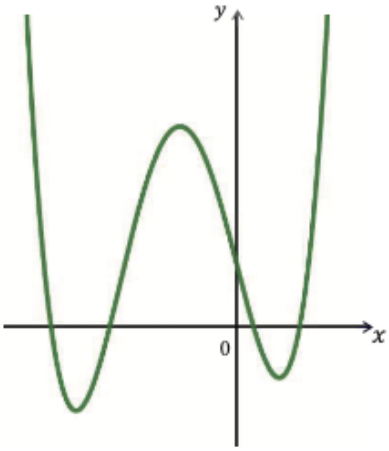
A)



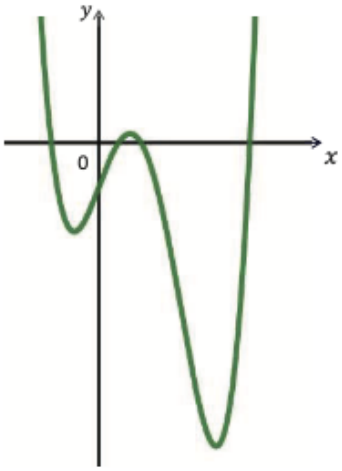
B)



C)

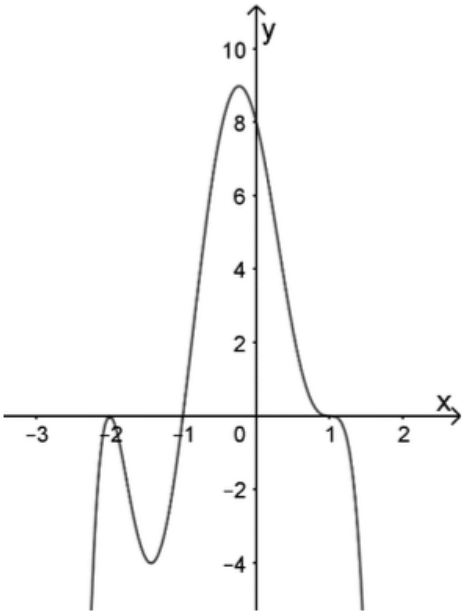


D)



Q28 2020 Blacktown Boys Prelim Q7 · **1 mark**

The diagram below shows the graph of $y = a(x+b)(x+c)^2(x+d)^3$. What are possible values of a, b, c and d?



(A) $a = -2,\ b = 1,\ c = 2,\ d = -1$

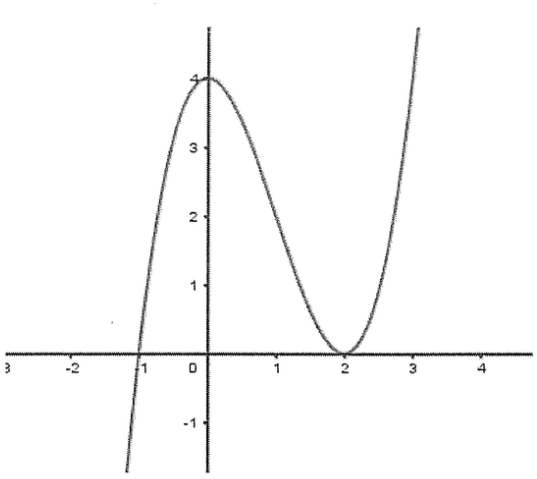
(B) $a = -2,\ b = -1,\ c = -2,\ d = 1$

(C) $a = 8,\ b = 1,\ c = 2,\ d = -1$

(D) $a = 8,\ b = -1,\ c = -2,\ d = 1$

Q29 2022 Girraween Prelim Q4 · **1 mark**

The diagram below shows the graph of a monic cubic polynomial $P(x)$.



The values of k such that the curve $y = P(x - k)$ passes through the origin are

(A) $k = 1$ or $k = -2$

(B) $k = -1$ or $k = 2$

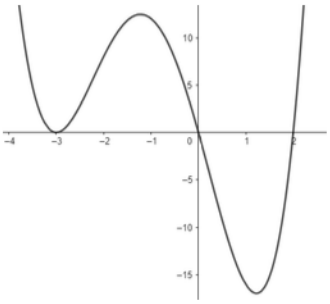
(C) $k = 1$ or $k = 2$

(D) $k = -1$ or $k = -2$

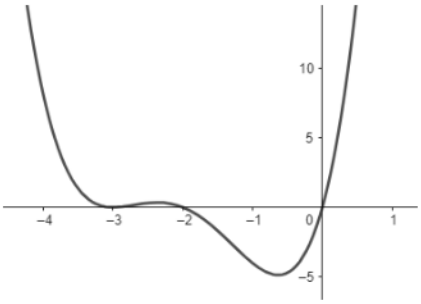
Q30 2024 Hurlstone Prelim Q9 · **1 mark**

Which of the following is the graph of $y = x(x+3)^2(2-x)$?

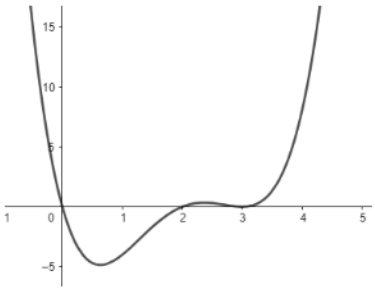
A.



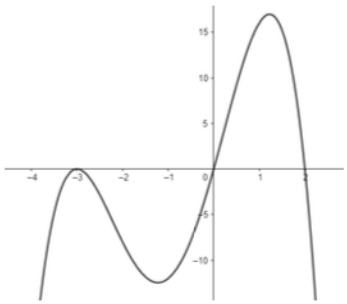
B.



C.

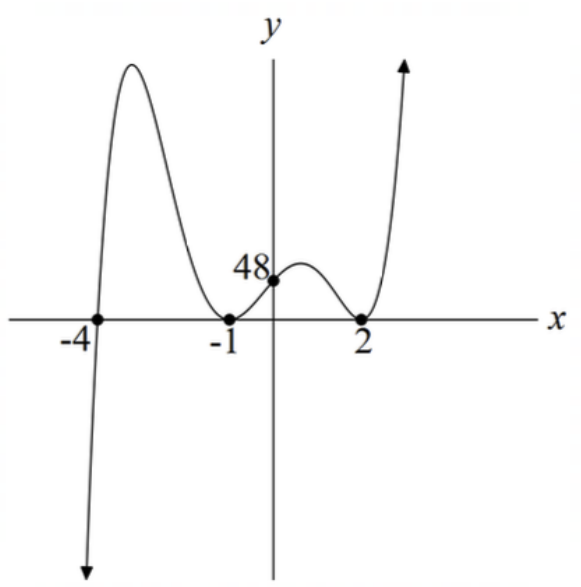


D.



Q31 2020 International Grammar Prelim Q8 · **1 mark**

The diagram shows the graph of $y = a(x + b)^2(x + c)^2(x + d)$. What are possible values of a, b, c and d?



(A) $a = 3,\ b = 4,\ c = 1,\ d = 2$

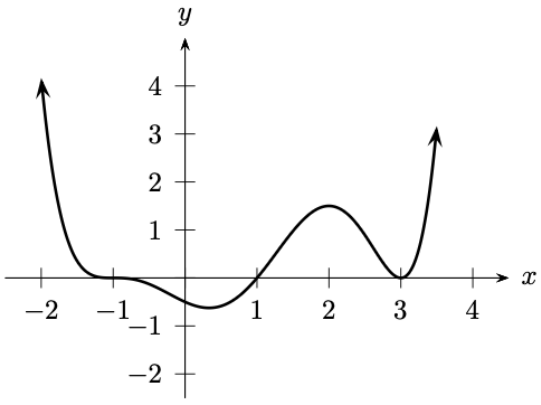
(B) $a = 6,\ b = 4,\ c = 1,\ d = 2$

(C) $a = 3,\ b = -2,\ c = 1,\ d = 4$

(D) $a = 6,\ b = -2,\ c = 1,\ d = 4$

Q32 2023 Normanhurst Boys Trial Q11(c)(i) · **1 mark**

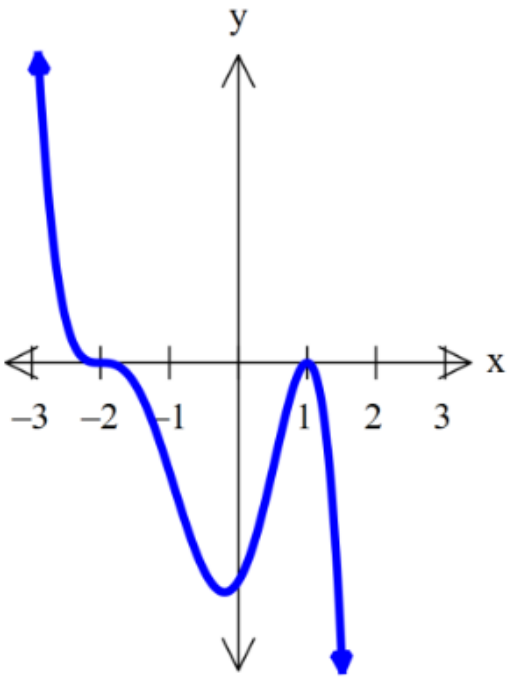
The graph of the polynomial function $y = P(x)$ is given below.



Without using calculus, write down a possible equation of $y = P(x)$.

Q33 2021 Presbyterian Prelim Q3 · **1 mark**

Which equation best represents the following graph?



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

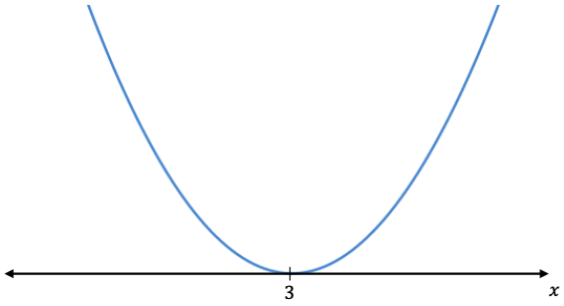
(B) $y = -(x-1)^2(x+2)^3$

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

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

Q34 2022 St George Girls Prelim Q4 · **1 mark**

Part of the graph of $y = P(x)$ is shown below.



Which of the following could be the equation of $P(x)$?

(A) $P(x) = (x-4)(x+3)^2(x-3)^2$

(B) $P(x) = (x-4)(x+3)^3(x-3)^3$

(C) $P(x) = -(x-4)(x+3)^2(x-3)^2$

(D) $P(x) = -(x-4)(x+3)^3(x-3)^3$

Q35 2023 Glenwood Trial Q11(a) · **2 marks**

Find the equation of the quartic shown below.

