

Polynomial Functions: math practice, Grade 11 – download the PDF

21 problems graded by difficulty (★ easy, ★★ medium, ★★★ hard). Try first, without looking at the solutions!

1 Is it a polynomial?



Decide whether each function is a polynomial function. Explain briefly.

a. $f(x) = 5x^3 - \sqrt{2}x + 1$

b. $g(x) = \frac{4}{x} + x$

c. $h(x) = \sqrt{x} + 3$

d. $j(x) = \frac{x^2 + 1}{3}$

2 Standard form and degree



Write $f(x) = 9 - x + 7x^5 - 4x^3$ in standard form, then give its degree, leading coefficient and constant term.

3 Adding and subtracting



Simplify.

a. $(4x^3 - 2x^2 + x - 8) + (-x^3 + 5x^2 - 3x + 2)$

b. $(6x^2 + x - 4) - (2x^2 - 3x + 9)$

4 Multiplying binomials



Expand and simplify: (a) $(x + 5)(x - 3)$ (b) $(2x - 1)(3x + 4)$.

5 Evaluating with the Remainder Theorem



Let $p(x) = x^3 - 2x^2 + 5x - 1$. Find $p(2)$ and $p(-1)$. What are the remainders when $p(x)$ is divided by $x - 2$ and by $x + 1$?

6 A first synthetic division



Use synthetic division to divide $x^3 + 2x^2 - 5x - 6$ by $x - 2$.

7 Cubes in two steps



Factor: (a) $x^3 + 64$ (b) $8x^3 - 1$.

8 Reading end behavior



Describe what the graph does as $x \rightarrow -\infty$ and as $x \rightarrow +\infty$ for each function.

a. $f(x) = -2x^3 + x$

b. $g(x) = x^4 - 3x$

c. $h(x) = -x^2 + 5$

d. $j(x) = 3x^5 - x^2$

9 Long division with a remainder



Divide $x^3 - 6x^2 + 11x - 7$ by $x - 2$ using long division, and write the result as

$$p(x) = d(x)q(x) + r.$$

10 Missing terms



Divide $3x^3 + 2x - 5$ by $x + 1$. Be careful with the missing x^2 term.

11 Synthetic division, degree 4



Use synthetic division to divide $2x^4 - 5x^3 - x + 6$ by $x - 2$, and then state $p(2)$ for

$$p(x) = 2x^4 - 5x^3 - x + 6.$$

12 Finding a missing coefficient



The polynomial $p(x) = x^3 + kx^2 - 4x - 12$ has $x + 3$ as a factor. Find k , then factor $p(x)$ completely.

13 The packaging box



A box has width x inches, length $(x + 4)$ inches and height $(x - 1)$ inches. Its volume is 42 cubic inches. Find the dimensions of the box in inches and in centimeters (1 in = 2.54 cm).

14 Rational root candidates



List all possible rational zeros of $p(x) = 3x^3 - x^2 + 8x - 10$. Then find the real zero and the other two zeros.

15 Sum and difference of cubes

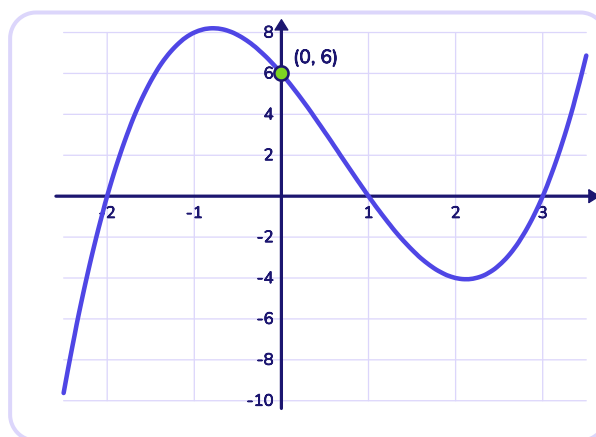


Factor completely: (a) $125x^3 + 27$ (b) $54x^3 - 2$.

16 Reading a graph



The graph shows a cubic polynomial function k with a leading coefficient of 1.



- Read the zeros from the graph.
- Write $k(x)$ in factored form and check it with the y-intercept $(0, 6)$.
- Describe the end behavior.

17 Solving a cubic completely

★★★

Solve $2x^3 - x^2 - 13x - 6 = 0$.

18 Building a polynomial from its zeros

★★★

Find a polynomial with real coefficients, leading coefficient **1** and the smallest possible degree, whose zeros include **2** and **$1 + 3i$** . Write it in standard form.

19 Six zeros

★★★

Find all complex zeros of $x^6 - 64$. *Hint: write it as a difference of cubes, then factor each cubic.*

20 Two conditions, two unknowns

★★★

Let $p(x) = x^3 + ax^2 + bx - 6$. When $p(x)$ is divided by $x - 1$ the remainder is -8 , and $x + 1$ is a factor of $p(x)$. Find a and b , then factor $p(x)$ completely.

21 True or false?

★★★

Decide whether each statement is true or false and justify your answer.

- Every real polynomial of odd degree has at least one real zero.
- A real polynomial of degree **4** can have no real zeros.
- A polynomial of degree **5** always has exactly **5** different real zeros.



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