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3.19 Test: Rational exponents and complex numbers

A1-APR.1 Perform operations with polynomials

1. Find the sum in standard form:

$$(-3x^3 + 2x^2 + 7x - 4) + (5x^3 + x^2 - 3x + 9).$$

2. Find the difference $f(x) - g(x)$ as a polynomial in standard form, given:

$$f(x) = x^4 - 3x^3 - 3x^2 - 2x + 5 \quad \text{and} \quad g(x) = 2x^4 - x^3 + 2x + 5.$$

3. Select each correct equation.

(a) $x^2 + 14 = x^2 + 7^2$

(b) $x^2 + 49 = (x - 7)(x + 7)$

(c) $x^2 - 49 = (x - 7)(x + 7)$

(d) $x^2 + 14x + 49 = (x - 7)^2$

(e) $x^2 - 14x + 49 = (x + 7)^2$

(f) $x^2 - 14x + 49 = (x - 7)^2$

4. Which equations represent correct polynomial identities?

(a) $x^3 - y^3 = (x - y)^3$

(b) $x^3 - y^3 = (x + y)(x^2 + xy + y^2)$

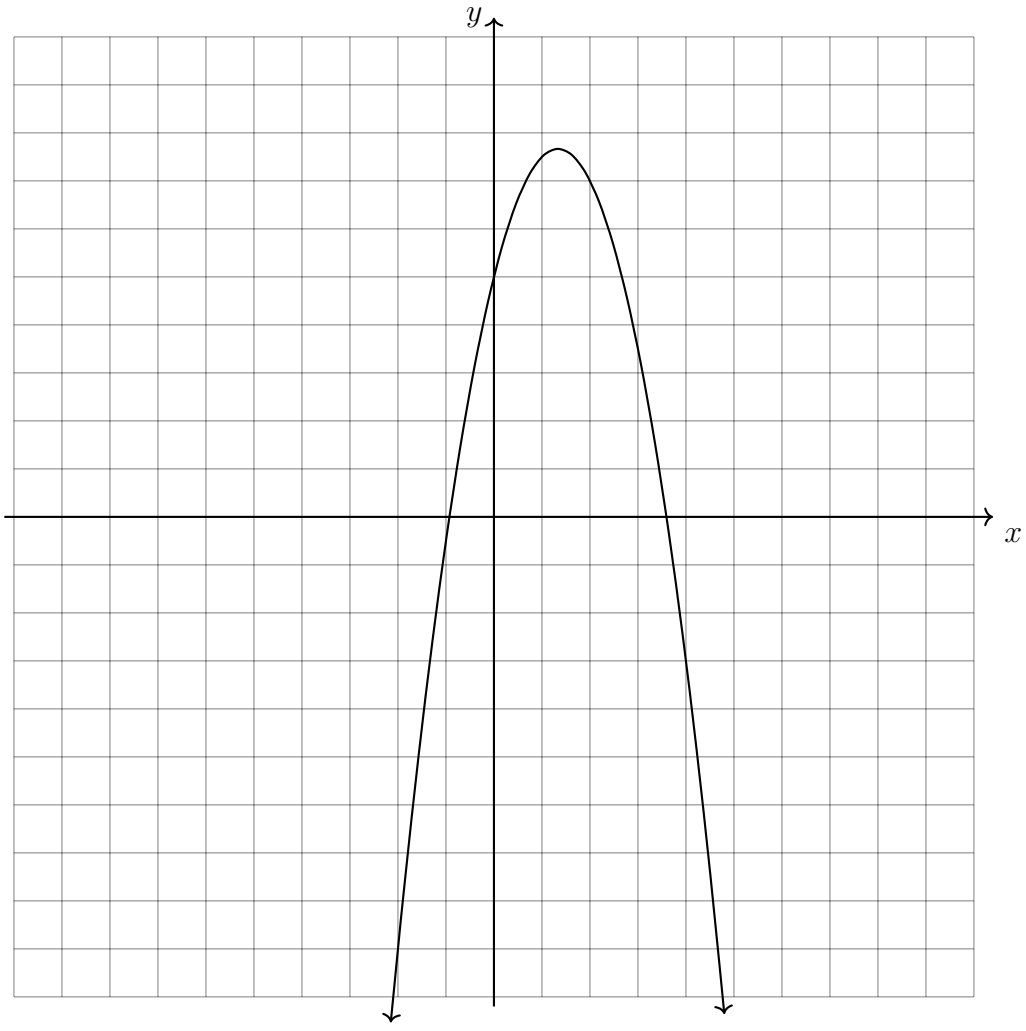
(c) $x^3 + y^3 = (x + y)(x^2 - xy + y^2)$

(d) $x^3 + y^3 = (x - y)(x^2 - xy + y^2)$

A1-F.IF.7a Graph linear and quadratic functions, show key features

5. One equation of a system is graphed.
   (a) Graph the second equation, labeling the intersections as ordered pairs.
   (b) Find the value of the leading coefficient a of the quadratic equation.

$y = ax^2 + 4x + 5$ $\qquad\qquad$ $x - y = 7$



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A2-A.APR.3 Identify zeros of polynomials given suitable factorizations

6. Write down the solutions to the equation $(x-7)(4x+3)(x-2)=0$.

7. The polynomial p is a function of x. The graph of p has zeros at 0, 3, $\frac{5}{3}$, and -7. Select **all** the expressions that could represent p.

   (a) $(x-3)(x-\frac{5}{3})(x+7)$
   (b) $x(x+3)(5x-3)(x+7)$
   (c) $3(x+3)(x-\frac{5}{3})(x+7)$
   (d) $3x(x-3)(x-\frac{5}{3})(x+7)^2$
   (e) $(x-3)(x+\frac{5}{3})(x-7)$
   (f) $x(x-3)(3x-5)(x+7)$
   (g) $3(x-3)(x-\frac{5}{3})(x-7)$
   (h) $3x(x-3)(x-\frac{3}{5})(x+7)^2$

A2-A.REI.2 Solve rational and radical equations, identify extraneous solutions

8. Square both sides of the equation and solve for x.

   (a) $\sqrt{x+9}=4$
   (b) Check your solution.

9. Solve for x and check.

   (a) $\sqrt{5x+16}+5=14$
   (b) Check your solution.

10. Select the expression that is equivalent to $\dfrac{5x^2+2x-30}{x-3}$ for $x \neq 3$.

    (a) $5x-13+\dfrac{16}{x-3}$

    (b) $5x+17+\dfrac{21}{x-3}$

    (c) $5x-13+\dfrac{8}{x-3}$

    (d) $5x+17+\dfrac{15}{x-3}$

11. Solve for x. $\dfrac{8}{x+3}=\dfrac{x+1}{x}$

A2-F.BF.2 Write arithmetic and geometric sequences with recursive formulas

12. Write a recursive definition of the sequence $a_1 = 0.25$, $a_2 = 0.75$, $a_3 = 1.25$, $a_4 = 1.75, \ldots$

13. Write a recursive definition of the geometric sequence b.

n	b_n
1	-1
2	5
3	-25

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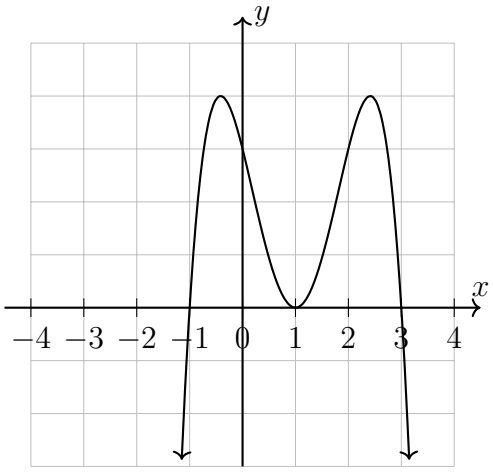
A2-F.IF.7c Graph polynomials, identify zeros, end behavior

14. Below is a graph of the polynomial $g(x)$.



(a) Is the leading coefficient positive or negative?

(b) Which of the following could be its equation?

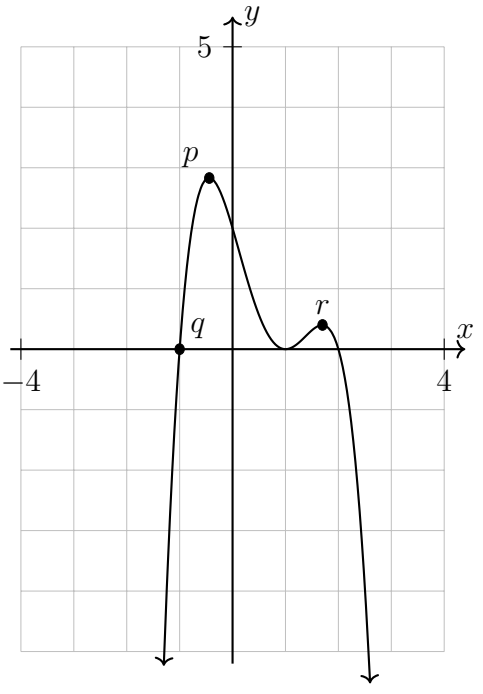
i. $g(x) = -(x+1)(x-3)(x-1)^2$

ii. $g(x) = -(x-1)(x-3)(x+1)^2$

iii. $g(x) = -(x+1)(x+3)(x-1)^2$

iv. $g(x) = -(x-1)(x+3)(x+1)^2$

15. The graph of the polynomial $-x^4 + 3x^3 - x^2 - 3x + 2$ is shown.



(a) What is the degree of the function?

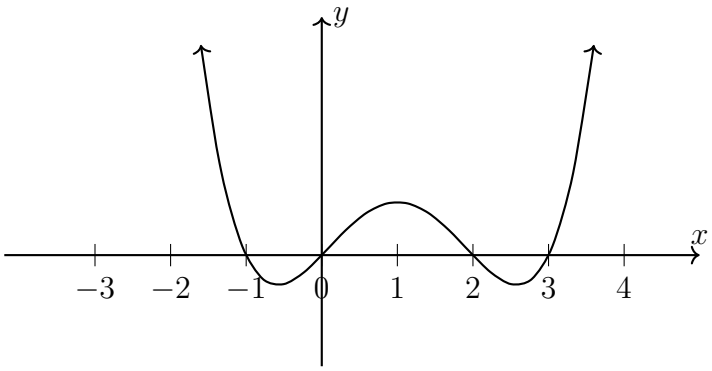
(b) What are the zeros of the function?

(c) Which factor has a multiplicity of 2?

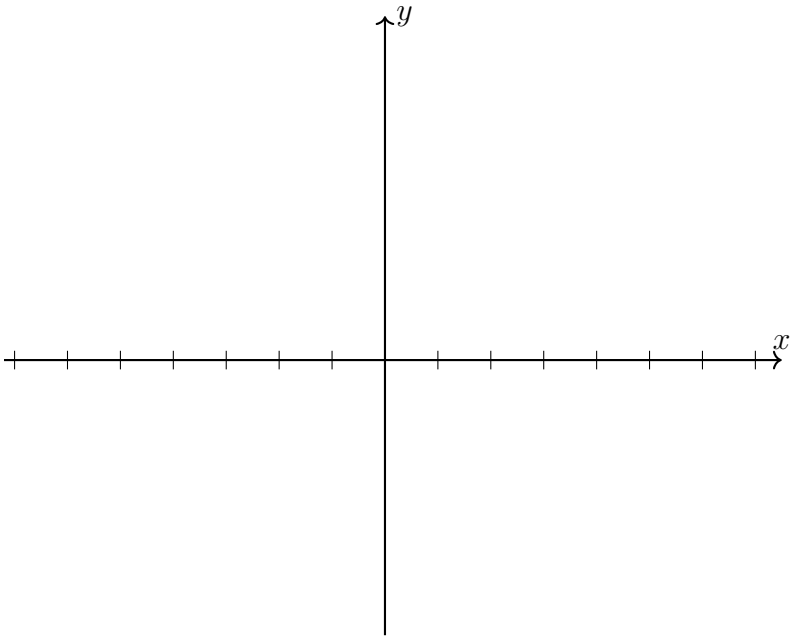
(d) Write down the y-intercept as an ordered pair.

(e) Three points are marked on the graph, p, q, and r. Which one is a local maximum?

16. The graph of the function $f(x) = x^4 - 4x^3 + x^2 + 6x$ is shown. Write the function in factored form.



17. Let $j(x) = x(x+3)(x-2)(x-5)$ be a polynomial function.



(a) Sketch a graph of the function. Label the x-intercepts.

(b) Find the value of the y-intercept and mark it on the graph.

(c) Identify the end behavior of the function.

i. As $x \to +\infty$, $y \to +\infty$;
as $x \to -\infty$, $y \to -\infty$

ii. As $x \to +\infty$, $y \to -\infty$;
as $x \to -\infty$, $y \to +\infty$

iii. As $x \to +\infty$, $y \to +\infty$;
as $x \to -\infty$, $y \to +\infty$

iv. As $x \to +\infty$, $y \to -\infty$;
as $x \to -\infty$, $y \to -\infty$

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A2.N.CN.2 Apply the properties of complex numbers

18. Write each expression in the form $a + bi$ with a, b real numbers.

    Given $s = 2 - 5i$ and $t = 9 - 3i$.

    (a) $s + t =$

    (b) $s - t =$

    (c) $st =$

19. If $(6 - ki)^2 = 27 - 36i$, the value of k is

    (a) -36

    (b) -3

    (c) 3

    (d) 6

20. Does the equation $x^2 - 4x + 13 = 0$ have imaginary solutions? Justify your answer.

A2.HSN.RN.2 Expressions with radicals and rational exponents

21. Simplify each radical expression, using complex numbers as necessary.

(a) $\sqrt{64} =$

(b) $\sqrt{27} =$

(c) $\sqrt{-9} =$

(d) $\dfrac{\sqrt{-50}}{\sqrt{2}} =$

22. Simplify each expression.

(a) $125^{\frac{2}{3}} =$

(b) $\left(\sqrt[3]{\frac{8}{27}}\right)^2 =$

23. Rewrite each expression as a fractional exponent in simplest terms. $x > 0$

(a) $\sqrt[3]{7} =$

(b) $\dfrac{1}{\sqrt[3]{5}} =$

(c) $\sqrt[2]{x^4} =$

(d) $\dfrac{1}{(\sqrt[3]{x})^2} =$

24. Rewrite each expression with fractional exponent as a radical.

(a) $5^{\frac{1}{4}} =$

(b) $5^{-\frac{1}{3}} =$

(c) $x^{\frac{2}{5}} =$

(d) $x^{-\frac{1}{3}} =$