

### 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)  $x^2 + 14 = x^2 + 7^2$

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

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

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

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

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

4. Which equations represent correct polynomial identities?

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

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

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

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

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

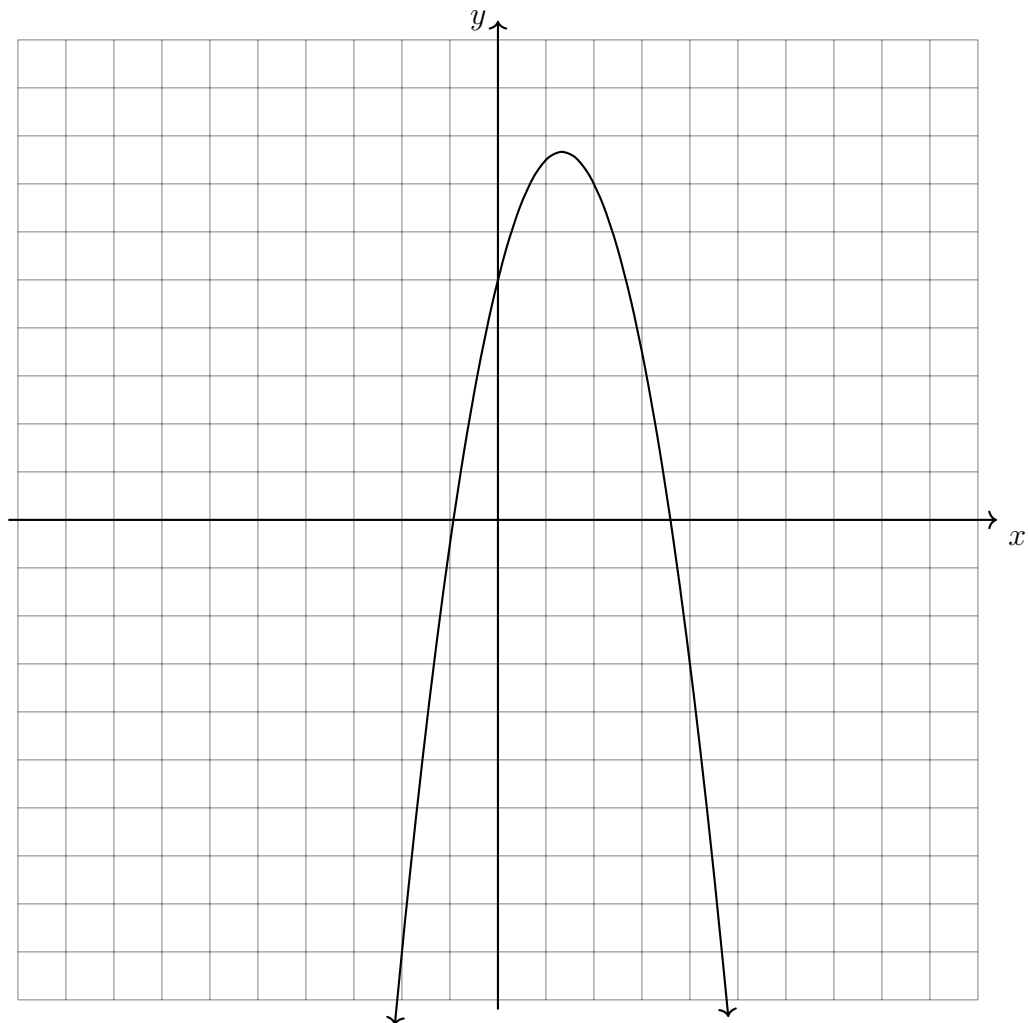
5. One equation of a system is graphed.

(a) Graph the second equation, labeling the intersections as ordered pairs.

(b) Find the value of the leading coefficient  $a$  of the quadratic equation.

$$y = ax^2 + 4x + 5$$

$$x - y = 7$$



**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) $(x - 3)(x - \frac{5}{3})(x + 7)$     | (e) $(x - 3)(x + \frac{5}{3})(x - 7)$     |
| (b) $x(x + 3)(5x - 3)(x + 7)$             | (f) $x(x - 3)(3x - 5)(x + 7)$             |
| (c) $3(x + 3)(x - \frac{5}{3})(x + 7)$    | (g) $3(x - 3)(x - \frac{5}{3})(x - 7)$    |
| (d) $3x(x - 3)(x - \frac{5}{3})(x + 7)^2$ | (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  $\frac{5x^2 + 2x - 30}{x - 3}$  for  $x \neq 3$ .

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

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

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

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

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

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

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

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

$n$	$b_n$
1	-1
2	5
3	-25

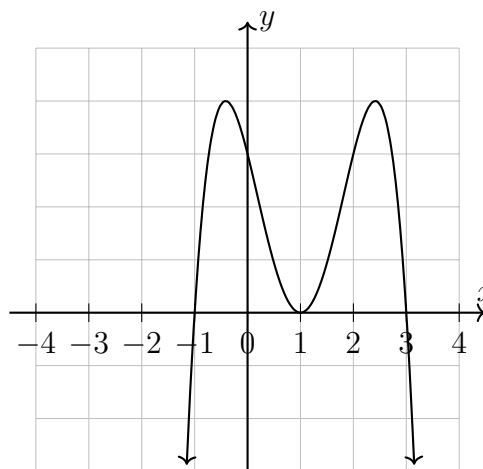
**A2-F.IF.7c Graph polynomials, identify zeros, end behavior**

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.

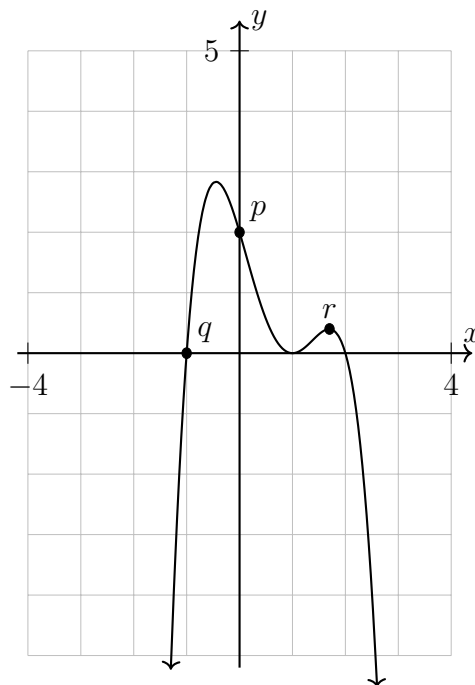
(a) What is the degree of the function?

(b) What are the zeros of the function?

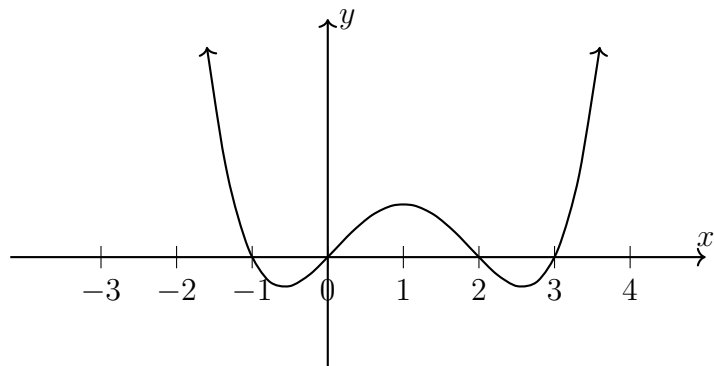
(c) Which factor has a multiplicity of 2?

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

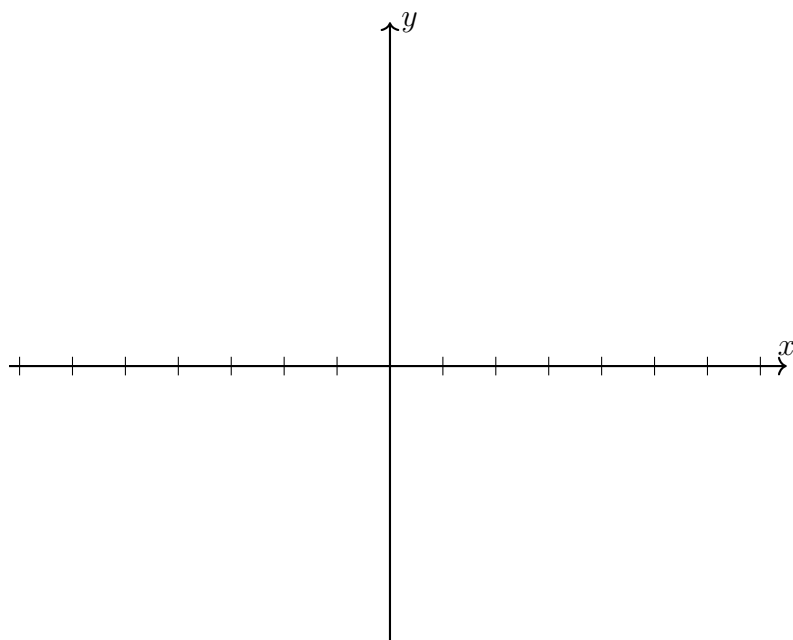
(e) Three points are marked on the graph,  $p$ ,  $q$ , and  $r$ . Which one is a local maximum?



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 $x \rightarrow +\infty$ , $y \rightarrow +\infty$ ;<br>as $x \rightarrow -\infty$ , $y \rightarrow -\infty$  | iii. As $x \rightarrow +\infty$ , $y \rightarrow +\infty$ ;<br>as $x \rightarrow -\infty$ , $y \rightarrow +\infty$ |
| ii. As $x \rightarrow +\infty$ , $y \rightarrow -\infty$ ;<br>as $x \rightarrow -\infty$ , $y \rightarrow +\infty$ | iv. As $x \rightarrow +\infty$ , $y \rightarrow -\infty$ ;<br>as $x \rightarrow -\infty$ , $y \rightarrow -\infty$  |

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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)  $\sqrt{64} =$

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

(b)  $\sqrt{27} =$

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

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

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

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

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

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

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

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

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

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