PRACTICE & PROBLEM SOLVING

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Practice Tutorial

Additional Exercises Available Online

UNDERSTAND

10. Generalize Explain two methods by which $(2m^3 + 4n^2)^2$ can be simplified. Which method do you prefer and why?

11. Use Structure Polynomial function P is the sum of two polynomial functions, one with degree 2 and a positive leading coefficient and one with degree 3 and a negative leading coefficient. Describe the end behavior of P. Write an example of two polynomial functions and their sum, P, to justify your description.

12. Generalize Multiply the polynomials $(a + b)(a + b)(a + b)$ to develop a general formula for cubing a binomial, $(a + b)^3$.

13. Reason Polynomial function R is the difference of two degree-two polynomial functions. What are the possible degrees for R? Explain.

14. Error Analysis Describe and correct the error a student made in multiplying the polynomials.

$$(y - 2)(3y^2 - y - 7)$$
$$= y(3y^2 - y - 7) - 2(3y^2 - y - 7)$$
$$= 3y^3 - y^2 - 7y + (-6y^2) + (-2y) - 14$$
$$= 3y^3 - 7y^2 - 9y - 14$$

✗

15. Higher Order Thinking Do you think polynomials are closed under division? Explain why you think so, or provide a counterexample.

16. Construct Arguments Explain why the expression $9x^3 + \frac{1}{2}x^2 + 3x^{-1}$ is not a polynomial.

17. Communicate Precisely Explain the difference between the graphs of polynomial functions with a degree of 3 that have a positive leading coefficient and the graphs of those with a negative leading coefficient.

PRACTICE

Add or subtract the polynomials. SEE EXAMPLE 1

18. $(2x^3 + 3x^2 + 4) + (6x^3 - x^2 - 5x)$

19. $(5y^4 + 3y^3 - 6y^2 + 14) - (-y^4 + y^2 - 7y - 1)$

20. $(4p^2q^2 + 2p^2q - 7pq) - (9p^2q^2 + 5pq^2 - 11pq)$

Multiply the polynomials. SEE EXAMPLE 2

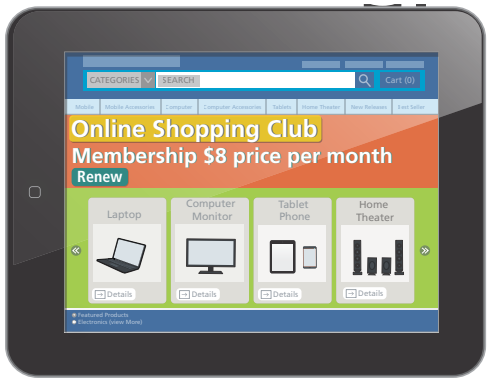
21. $-4xy(5x^2 - 9xy - y^2)$

22. $(3c - 4)(2c^2 - 5c + 7)$

23. $(z + 5)(z - 9)(1 - z)$

24. Is the set of monomials closed under addition? Explain why you think so, or provide a counterexample. SEE EXAMPLE 3

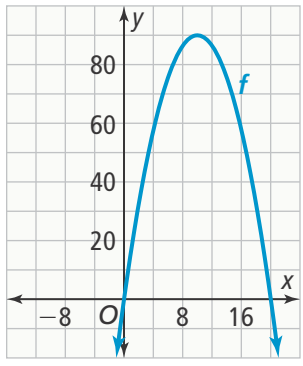
25. An online shopping club has 13,500 members when it charges $8 per month for membership. For each $1 monthly increase in membership fee, the club loses approximately 500 of its existing members.



Write and simplify a function R to represent the monthly revenue received by the club when x represents the price increase.

Hint Monthly revenue = # members • monthly fee SEE EXAMPLE 4

26. The graph shows a polynomial function f. Polynomial function $g = x^2(6 - x)$. Compare the maximum values and the end behavior of the functions f and g when $x > 0$. SEE EXAMPLE 5



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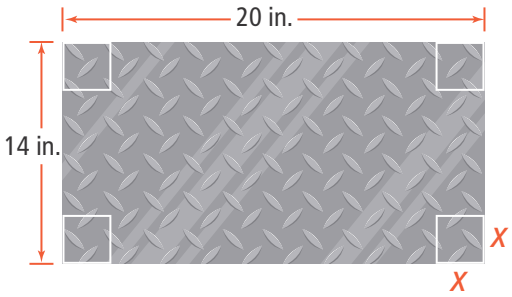
APPLY

Use this information for 27 and 28. A foundry manufactures aluminum trays from pieces of sheet metal as shown.

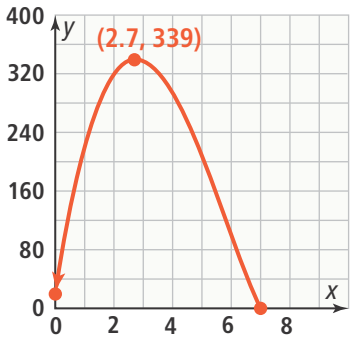


27. Model With Mathematics Let x represent the side length of each square.

a. Write expressions for the length, width, and height of the metal tray.

b. Write and simplify a polynomial function V to represent the volume of the tray.

c. Using the graph of the function V, explain what the marked vertex represents.



28. Reason Suppose the foundry manufacturer has a new design where the squares cut from the corners have sides that are half the length of the squares in the previous design.

a. Write expressions for the length, width, and height of this tray.

b. Write and simplify the polynomial function $v(x)$, to represent the volume of the new tray.

c. Write the function $D(x)$ that represents the difference, $V(x) - v(x)$.

29. Make Sense and Persevere Jacy has $1,000 to invest in a fund that pays approximately 4.6% per year or in a savings account with an annual interest rate of 1.8%. Write a polynomial function $S(x)$ to represent the interest Jacy will earn in 1 year by investing x dollars in the fund and the remainder in the savings account.

ASSESSMENT PRACTICE

30. Are polynomials open or closed under each operation? Classify each operation as *open* or *closed*.

a. addition

b. subtraction

c. multiplication

d. division

31. SAT/ACT Which of the following functions is NOT a polynomial function?

Ⓐ $2y^2 + 9y - 8$

Ⓑ $-\frac{1}{2}x^3 + 8$

Ⓒ $(x - 1)(5 - x)(x + 4)$

Ⓓ $9z^4 + 2z + \frac{1}{z}$

32. Performance Task Consider the polynomial functions $P(x) = x^2 - 4$ and $R(x) = -x^2 - 2x$.

Part A Write and simplify a polynomial function $T(x)$ that is the product of P and R.

Part B Copy and complete the table of values for all three functions.

x	$P(x)$	$R(x)$	$T(x)$
–3			
–2			
–1			
0			
1			
2			
3			

Part C Graph the functions on the same coordinate grid.

Part D How do the zeros of T relate to the zeros of P and R?

Part E Explain how you can identify the intervals in which T is positive by analyzing the R and P.