## PRACTICE & PROBLEM SOLVING

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Practice Tutorial

Additional Exercises Available Online

### UNDERSTAND

8. **Reason** Write a polynomial division problem with a quotient of $x^2 - 5x + 7$ and a remainder of 2. Explain your reasoning. How can you verify your answer?

9. **Communicate Precisely** Show that $x - 3$ and $x + 5$ are factors of $x^4 + 2x^3 - 16x^2 - 2x + 15$. Explain your reasoning.

10. **Error Analysis** Alicia divided the polynomial $2x^3 - 4x^2 + 6x + 10$ by $x^2 + x$. Describe and correct the error Alicia made in dividing the polynomials.

$$2x - 6 + \frac{10}{x^2 + x}$$

$$x^2 + x \overline{)\,2x^3 - 4x^2 + 6x + 10}$$

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

$$-6x^2 + 6x$$

$$-(-6x^2 - 6x)$$

$$10$$

✗

11. **Higher Order Thinking** When dividing polynomial $P(x)$ by polynomial $d(x)$, the remainder is $R(x)$. The remainder can also be written as $\frac{R(x)}{d(x)}$. How can you use the degrees of $R(x)$ and $d(x)$ to determine you are finished dividing?

12. **Look for Relationships** When dividing polynomial $P(x)$ by polynomial $x - n$, the remainder is 0. When graphing $P(x)$, what is an $x$-intercept of the graph?

13. **Reason** When dividing $x^3 + nx^2 + 4nx - 6$ by $x + 3$, the remainder is $-48$. What is the value of $n$?

14. **Mathematical Connections** Use polynomial long division to divide $8x^3 + 27$ by $2x + 3$. How can you use multiplication to check your answer? Show your work.

### PRACTICE

**Use long division to divide.** SEE EXAMPLE 1

15. $x^3 + 5x^2 - x - 5$ divided by $x - 1$

16. $2x^3 + 9x^2 + 10x + 3$ divided by $2x + 1$

17. $3x^3 - 2x^2 + 7x + 9$ divided by $x^2 - 3x$

18. $2x^4 - 6x^2 + 3$ divided by $2x - 6$

**Use synthetic division to divide.** SEE EXAMPLE 2

19. $x^4 - 25x^2 + 144$ divided by $x - 4$

20. $x^3 + 6x^2 + 3x - 10$ divided by $x + 5$

21. $x^5 + 2x^4 - 3x^3 + x - 1$ divided by $x + 2$

22. $-x^4 + 7x^3 + x^2 - 2x - 12$ divided by $x - 3$

23. Use synthetic division to show that the remainder of $f(x) = x^4 - 6x^3 - 33x^2 + 46x + 75$ divided by $x - 9$ is $P(9)$. SEE EXAMPLE 3

**Use the Remainder Theorem to evaluate each polynomial for the given value of $x$.** SEE EXAMPLE 4

24. $f(x) = x^3 + 9x^2 + 3x - 7$; $x = -5$

25. $f(x) = 2x^3 - 3x^2 + 4x + 13$; $x = 3$

26. $f(x) = -x^4 + 2x^3 - x^2 + 4x + 8$; $x = -2$

27. $f(x) = x^5 - 3x^4 - 2x^3 + x^2 - 2x - 1$; $x = 4$

**Is each given binomial a factor of the given polynomial? If so, write the polynomial as a product of two factors.** SEE EXAMPLE 5

28. polynomial: $P(x) = 8x^3 - 10x^2 + 28x - 16$; binomial: $x - 3$

29. polynomial: $P(x) = 4x^4 - 9x^3 - 7x^2 - 2x + 25$; binomial: $x + 4$

30. polynomial: $P(x) = -x^5 + 12x^3 + 6x^2 - 23x + 1$; binomial: $x - 2$

31. polynomial: $P(x) = 2x^3 + 3x^2 - 8x - 12$; binomial: $2x + 3$

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Mixed Review Available Online

### APPLY

**32. Model With Mathematics** Darren is placing shipping boxes in a storage unit with a floor area of $x^4 + 5x^3 + x^2 - 20x - 14$ square units. Each box has a volume of $x^3 + 10x^2 + 29x + 20$ cubic units and can hold a stack of items with a height of $x + 5$ units.

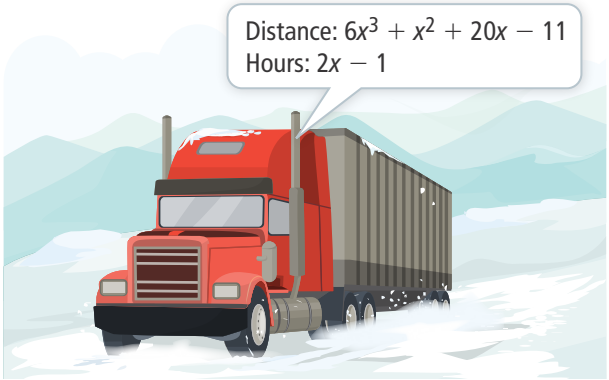

**a.** How much floor space will each box cover?

**b.** What is the maximum number of boxes Darren can place on the floor of the storage unit?

**c.** Assume Darren places the maximum number of boxes on the floor of the storage unit, with no overlap. How much of the floor space is not covered by a box?

**33. Reason** Lauren wants to determine the length and height of her DVD stand. The function $f(x) = x^3 + 14x^2 + 57x + 72$ represents the volume of the DVD stand, where the width is $x + 3$ units. What are possible dimensions for the length and height of the DVD stand? Explain.

**34. Make Sense and Persevere** A truck traveled $6x^3 + x^2 + 20x - 11$ miles in $2x - 1$ hours. At what rate did the semi-truck travel? (*Hint:* Use the formula $d = rt$, where $d$ is the distance, $r$ is the rate, and $t$ is the time.)




### ASSESSMENT PRACTICE

**35.** When polynomial $P(x)$ is divided by the linear factor $x - n$, the remainder is 0. What can you conclude? Select all that apply.

Ⓐ $P(x) = 0$
Ⓑ $P(n) = 0$
Ⓒ $P(-n) = 0$
Ⓓ $x - n$ is a factor of $P(x)$.
Ⓔ $x + n$ is a factor of $P(x)$.

**36. SAT/ACT** $x + 3$ is a factor of the polynomial $x^3 + 2x^2 - 5x + n$. What is the value of $n$?

Ⓐ $-6$
Ⓑ $-3$
Ⓒ $-2$
Ⓓ 3
Ⓔ 6

**37. Performance Task** The table shows some quotients of the polynomial $x^n - 1$ divided by the linear factor $x - 1$.

| Dividend | Divisor | Quotient |
|---|---|---|
| $x^2 - 1$ | $x - 1$ | $x + 1$ |
| $x^3 - 1$ | $x - 1$ | $x^2 + x + 1$ |
| $x^4 - 1$ | $x - 1$ | |
| $x^5 - 1$ | $x - 1$ | |
| $x^6 - 1$ | $x - 1$ | |

**Part A** Use long division or synthetic division to find the missing quotients to complete the table.

**Part B** Look for a pattern. Then describe the pattern when $x^n - 1$ is divided by $x - 1$.

**Part C** Use the pattern to find the quotient when $x^{10} - 1$ is divided by $x - 1$.