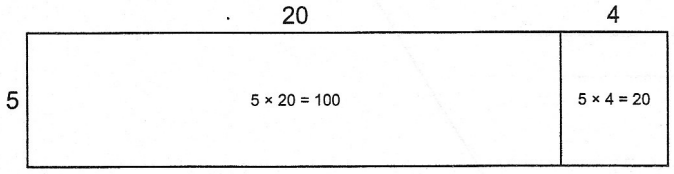
# 5.5 Skill Builder

## The Distributive Property

We can use this diagram to model $5 \times 24$.




This diagram shows:

$$\begin{aligned} 5 \times 24 &= 5 \times (20 + 4) \\ &= (5 \times 20) + (5 \times 4) \\ &= 100 + 20 \\ &= 120 \end{aligned}$$

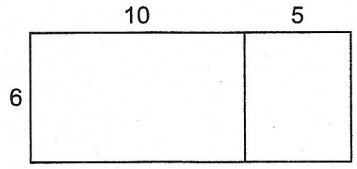
*We multiply the term outside the brackets by each term inside the brackets, then find the sum.*

This shows the **distributive property** of multiplication.

## Check

**1.** How does each diagram show the distributive property?

**a)**

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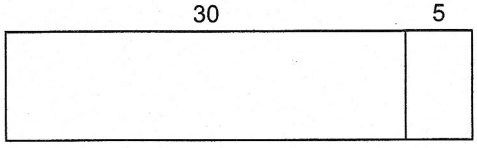
**b)**

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**2.** Use the distributive property to multiply.

**a)** $7 \times 21 = 7 \times (20 + 1)$

$= (7 \times 20) + (7 \times 1)$

$=$ _____

$=$ _____

**b)** $8 \times 43 = 8 \times (40 + 3)$

$=$ _____

$=$ _____

$=$ _____

## Multiplying and Dividing Integers

When multiplying or dividing 2 integers, look at the sign of each integer:

- When the integers have the same sign, their product or quotient is positive.
- When the integers have different signs, their product or quotient is negative.

| ×/÷ | (−) | (+) |
|---|---|---|
| (−) | (+) | (−) |
| (+) | (−) | (+) |

$7 \times (-4)$
$7 \times (-4) = -28$
These 2 integers have different signs, so their product is negative.

$(-12) \div (-3)$
$(-12) \div (-3) = 4$
These 2 integers have the same sign, so their quotient is positive.

*When one number is divided by another number, the result is called the quotient.*

### *Check*

**1.** Will the product be positive or negative?

**a)** $9 \times 5$ _____ **b)** $8 \times (-3)$ _____

**c)** $(-12) \times 5$ _____ **d)** $(-7) \times (-6)$ _____

**2.** Multiply.

**a)** $6 \times 5 =$ _____ **b)** $4 \times (-10) =$ _____

**c)** $(-7) \times 3 =$ _____ **d)** $(-8) \times (-6) =$ _____

**e)** $12 \times (-5) =$ _____ **f)** $(-4) \times (-8) =$ _____

**3.** Will the quotient be positive or negative?

**a)** $18 \div 3$ _____ **b)** $(-36) \div 6$ _____

**c)** $72 \div (-9)$ _____ **d)** $(-48) \div (-8)$ _____

**4.** Divide.

**a)** $(-49) \div 7 =$ _____ **b)** $(-56) \div (-8) =$ _____

**c)** $48 \div 6 =$ _____ **d)** $81 \div (-9) =$ _____

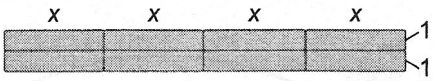
**e)** $(-27) \div (-3) =$ _____ **f)** $(-42) \div 7 =$ _____

# 5.5 Multiplying and Dividing a Polynomial by a Constant

**FOCUS** **Use different strategies to multiply and divide a polynomial by a constant.**

To multiply $2(4x)$ with algebra tiles:

Model 2 rows of 4 ▭.




There are 8 $x$-tiles. So, $2(4x) = 8x$

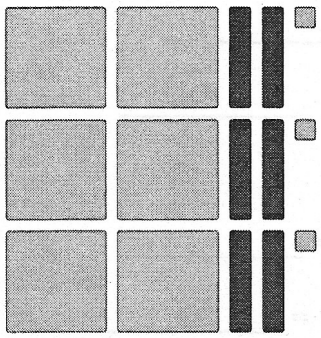
*Recall: $2(4x) = 2 \times 4x$*

## *Example 1* Using Algebra Tiles to Multiply a Polynomial by a Constant

Find the product: $3(2b^2 - 2b + 1)$

### *Solution*

$3(2b^2 - 2b + 1)$



Model 3 rows of 2 ▭, 2 ▬, and 1 ▫.
These tiles represent: $6b^2 - 6b + 3$.
So, $3(2b^2 - 2b + 1) = 6b^2 - 6b + 3$

### *Check*

**1.** Sketch algebra tiles to multiply. Write the product each time.

**a)** $3(4p - 3) =$ _____

**b)** $2(-s^2 + s + 3) =$ _____

When working symbolically, remember the rules for integer multiplication and division.

## Example 2 Using the Distributive Property to Multiply a Polynomial by a Constant

Find the product: $-5(4e^2 - 5e + 3)$

### Solution

$-5(4e^2 - 5e + 3)$ — Multiply each term in brackets by $-5$.

$= (-5)(4e^2) + (-5)(-5e) + (-5)(3)$ — Multiply.

$= -20e^2 + 25e + (-15)$

$= -20e^2 + 25e - 15$

### Check

**1.** Multiply.

**a)** $3(7s^2 + 9)$

$= 3(7s^2) + 3(9)$ — Multiply each term in brackets by 3.

$=$ ____$s^2 +$ ____ — Multiply: $3 \times 7 =$ ____ and $3 \times 9 =$ ____

**b)** $-4(5e^2 - 8e)$ — Multiply each term in brackets by $-4$.

$=$ _____ — Multiply.

$=$ _____

**c)** $-5(-2d^2 - 3d + 6)$

$=$ _____

$=$ _____

$=$ _____

**d)** $7(6y^2 - 8y + 9)$

$=$ _____

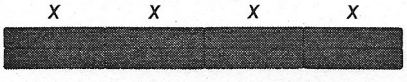
$=$ _____

$=$ _____

We can use algebra tiles to divide a polynomial by a constant.

To divide: $(-8x) \div 2$

Arrange 8  into 2 equal rows.




In each row there are 4 .

So, $(-8x) \div 2 = -4x$

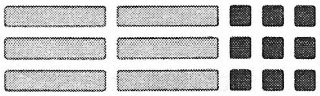
## Example 3 Using Algebra Tiles to Divide a Polynomial by a Constant

Find the quotient: $(6s - 9) \div 3$

### Solution

$(6s - 9) \div 3$

Arrange 6 ▭ and 9 ■ into 3 equal rows.



In each row, there are 2 ▭ and 3 ■.

So, $(6s - 9) \div 3 = 2s - 3$

### Check

**1.** Sketch algebra tiles to divide. Write the quotient each time.

**a)** $(3g^2 + 12g) \div 3 =$ _____

**b)** $(-4b^2 + 6) \div 2 =$ _____

**c)** $(4s^2 - 4s + 8) \div 4 =$ _____

**d)** $(-6t^2 + 9t - 9) \div 3 =$ _____

When algebra tiles are not available,
or when the divisor is negative,
we can use what we already know about division.

*In the division sentence $6 \div 3 = 2$, the divisor is 3.*

We can write $8x \div 4$ as a fraction: $\frac{8x}{4}$

We write the fraction as a product, then simplify each fraction.

$$\frac{8x}{4} = \frac{8}{4} \times x$$
$$= 2 \times x$$
$$= 2x$$

## Example 4 Dividing a Polynomial by a Constant Symbolically

Find the quotient: $\frac{-9v^2 + 6}{3}$

### Solution

$\frac{-9v^2 + 6}{3}$ Write as the sum of 2 fractions with denominator 3.

$= \frac{-9v^2}{3} + \frac{6}{3}$ Simplify the fractions.

$= \frac{-9}{3} \times v^2 + 2$ When 2 integers have different signs, the quotient is negative.

$= -3 \times v^2 + 2$

$= -3v^2 + 2$

### Check

**1.** Divide.

**a)** $\frac{12r^2 + 8}{4}$ Write as the sum of 2 fractions with denominator 4.

$= \frac{\quad}{4} + \frac{\quad}{4}$ Simplify the fractions.

$= \underline{\quad} \times r^2 + \underline{\quad}$ When 2 integers have the same sign, the quotient is _____.

$=$ _____

$=$ _____

**b)** $\frac{18v^2 - 6v + 12}{6}$

$= \frac{\quad}{6} + \frac{\quad}{6} + \frac{\quad}{6}$

$= \frac{\quad}{6} \times \_\_\_ + \frac{\quad}{6} \times \_\_\_ + \_\_\_$

$=$ _____

$=$ _____

**c)** $\frac{-4e^2 - 8e}{2}$

$=$ _____

$=$ _____

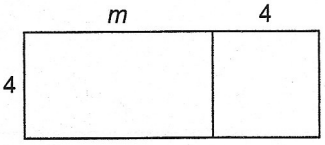
$=$ _____

$=$ _____

## Practice

**1.** Which multiplication sentence does each rectangle represent?

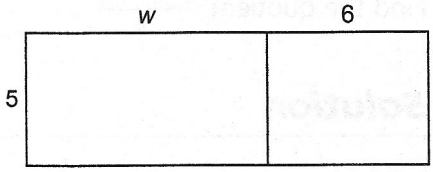
**a)**




$4(m + 4) = (4 \times \_\_\_) + (4 \times \_\_\_)$

$=$ _____

**b)**

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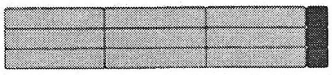
$=$ _____

**2.** Write the multiplication sentence modelled by each set of tiles.

**a)**



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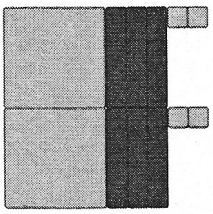
**b)**



_____

**3.** Sketch algebra tiles to multiply. Write the product each time.

**a)** $3(6r - 4) =$ _____

**b)** $2(-2b^2 - b + 3) =$ _____

**4.** Multiply.

**a)** $6(-4t^2 + 3)$

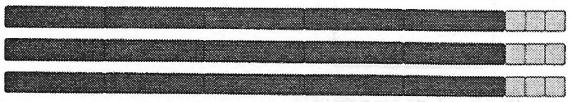
$= 6(\_\_\_\_) + 6(\_\_\_\_)$

$= \_\_\_\_\_$

**b)** $-8(-3k^2 - 2k + 4)$

$= \_\_\_\_\_$

**5.** Which of these quotients is modelled by the tiles below?



**a)** $(15x - 9) \div 3$

**b)** $(-15x - 9) \div 3$

**c)** $(-15x + 9) \div 3$

**6.** Sketch algebra tiles to divide. Write the quotient each time.

**a)** $(3h^2 - 15h) \div 3 = \_\_\_\_\_$

**b)** $(-2a^2 - 6a + 4) \div 2 = \_\_\_\_\_$

**7.** Divide.

**a)** $\frac{-10z^2 + 15}{5}$

$= \frac{\_\_\_\_}{5} + \frac{\_\_\_\_}{5}$

$= \_\_\_\_ \times z^2 + \_\_\_\_$

$= \_\_\_\_\_$

$= \_\_\_\_\_$

**b)** $\frac{7x^2 - 7x + 21}{-7}$

$= \_\_\_\_\_$

$= \_\_\_\_\_$

$= \_\_\_\_\_$

$= \_\_\_\_\_$