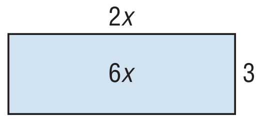
Multiplication and division are inverse operations. To divide a polynomial by a constant, we reverse the process of multiplication.

➤ The expression $6x \div 3$ is a division statement.
It represents the quotient of the monomial, $6x$, and the constant 3.
To model $6x \div 3$,
we arrange six x-tiles in 3 rows.
Each row contains two x-tiles.
So, $6x \div 3 = 2x$

We can also model $6x \div 3$ as one dimension of a rectangle with an area of $6x$ and the other dimension 3.



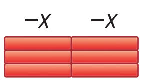
Then, $6x \div 3 = \frac{6x}{3}$
$= 2x$

We can use what we know about division as a fraction and integer division to determine the quotient.

$$\begin{aligned}\frac{6x}{3} &= \frac{6}{3} \times x \\ &= 2 \times x \\ &= 2x\end{aligned}$$

➤ $(-6x) \div 3$ is the quotient of the monomial, $-6x$, and the constant 3.

Using a model:
We arrange six $-x$-tiles in 3 rows.



Each row contains two $-x$-tiles.
So, $(-6x) \div 3 = -2x$

Using fractions and integers:
$(-6x) \div 3 = \frac{-6x}{3}$
Simplify the fraction.

$$\begin{aligned}(-6x) \div 3 &= \frac{-6}{3} \times x \\ &= -2 \times x \\ &= -2x\end{aligned}$$

➤ $6x \div (-3)$ is the quotient of the monomial, $6x$, and the constant -3.
Using fractions and integers:
$6x \div (-3) = \frac{6x}{-3}$
Simplify the fraction.

$$\begin{aligned}6x \div (-3) &= \frac{6}{-3} \times x \\ &= -2 \times x \\ &= -2x\end{aligned}$$

Discuss the ideas

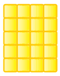
1. How could you use multiplication to verify the quotient in a division question?

2. Why can we not use algebra tiles to divide when the divisor is negative?

Practice

Check

3. Write the multiplication sentence modelled by each set of algebra tiles.

a) 

b) 

c) 

d) 

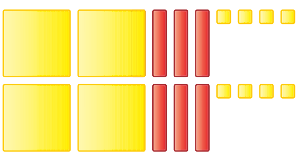
4. For each set of algebra tiles in question 3, write a division sentence.

5. a) Which of these products is modelled by the algebra tiles below?

i) $2(-2n^2 + 3n + 4)$

ii) $2(2n^2 - 3n + 4)$

iii) $-2(2n^2 - 3n + 4)$



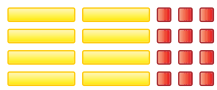
b) In part a, two of the products were not modelled by the algebra tiles. Model each product. Sketch the tiles you used.

6. Which of these quotients is modelled by the algebra tiles below?

a) $\dfrac{8t - 12}{-4}$

b) $\dfrac{-8t - 12}{4}$

c) $\dfrac{8t - 12}{4}$



Apply

7. a) Multiply.

i) $3(5r)$ ii) $-3(5r)$

iii) $(5r)(3)$ iv) $-5(3r)$

v) $-5(-3r)$ vi) $(-3r)(5)$

b) In part a, explain why some answers are the same.

c) For which products in part a could you have used algebra tiles? For each product, sketch the tiles you could use.

8. a) Divide.

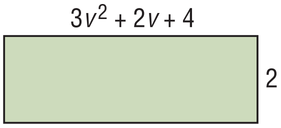
i) $\dfrac{12k}{4}$ ii) $(-12k) \div 4$

iii) $\dfrac{12k}{-4}$ iv) $(-12k) \div (-4)$

b) In part a, explain why some answers are the same.

c) For which quotients in part a could you have used algebra tiles? For each quotient, sketch the tiles you could use.

9. Write the multiplication sentence modelled by each rectangle.

a) 

b) 

10. For each rectangle in question 9, write a division sentence.

11. Use algebra tiles to determine each product. Sketch the tiles you used. Record the product symbolically.

a) $7(3s + 1)$
b) $-2(-7h + 4)$
c) $2(-3p^2 - 2p + 1)$
d) $-6(2v^2 - v + 5)$
e) $(-w^2 + 3w - 5)(3)$
f) $(x^2 + x)(-5)$

12. Here is a student's solution for this question:

$$-2(4v^2 - v + 7) = -2(4v^2) - 2(v) - 2(7)$$
$$= -8v^2 - 2v - 16$$

Identify the errors in the solution, then write the correct solution.

13. Use algebra tiles to determine each quotient. Sketch the tiles you used. Record the product symbolically.

a) $\dfrac{12p - 18}{6}$
b) $\dfrac{-6q^2 - 10}{2}$
c) $\dfrac{5h^2 - 20h}{5}$
d) $\dfrac{4r^2 - 16r + 6}{2}$
e) $\dfrac{-8a^2 + 4a - 12}{4}$
f) $\dfrac{6x^2 + 3x + 9}{3}$

14. Here is a student's solution for this question:
Divide: $(-14m^2 - 28m + 7) \div (-7)$

$$(-14m^2 - 28m + 7) \div (-7)$$
$$= \frac{-14m^2}{-7} + \frac{-28m}{7} + \frac{-7}{7}$$
$$= 2m^2 - 4m + 0$$
$$= -2m$$

Identify the errors in the solution, then write the correct solution.

15. Use any strategy to determine each product.

a) $-3(-4u^2 + 16u + 8)$
b) $12(2m^2 - 3m)$
c) $(5t^2 + 2t)(-4)$
d) $(-6s^2 - 5s - 7)(-5)$
e) $4(-7y^2 + 3y - 9)$
f) $10(8n^2 - n - 6)$

16. Use any strategy to determine each quotient.

a) $\dfrac{24d^2 - 12}{12}$
b) $\dfrac{8x + 4}{4}$
c) $\dfrac{-10 + 4m^2}{-2}$
d) $(25 - 5n) \div (-5)$
e) $(-14k^2 + 28k - 49) \div 7$
f) $\dfrac{30 - 36d^2 + 18d}{-6}$
g) $\dfrac{-26c^2 + 39c - 13}{-13}$

17. Which pairs of expressions are equivalent? Explain how you know.

a) $5j^2 + 4$ and $5(j + 4)$
b) $10x^2$ and $3x(x + 7)$
c) $15x - 10$ and $5(-2 + 3x)$
d) $-3(-4x - 1)$ and $12x^2 - 3x$
e) $-5(3x^2 - 7x + 2)$ and $-15x^2 + 12x - 10$
f) $2x(-3x - 7)$ and $-6x^2 - 14x$