Monomial Multiplication

**GOAL**
Multiply monomials.

**Learn about the Math**

Recall that $3 \times 3$ equals $3^2$. This also is true when multiplying a **first-degree monomial** by another first-degree monomial containing the same variable, such as $x \times x = x^2$.

When multiplying one **monomial** by another, if a variable is contained in only one of the terms being multiplied, then the variable remains to the first power in the product. For instance, only one term in the following example contains a $y$: $x \times xy$; therefore, the $y$ in the product remains to the first power, which results in $x^2y$.

If the terms contain coefficients, you multiply the coefficients together, forming the coefficient for the product.

Qi is trying to calculate the area of his classroom floor. The floor is covered by square tiles. There are 7 tiles across the width of the room and 10 tiles across the length. The width of each tile can be represented by $x$. Qi is then informed by the teacher that the width of each tile, $x$, is equal to 1 m.

**What is the area of the floor in Qi’s classroom?**

**Example 1: Multiplying first-degree monomials**

Calculate the area of Qi’s classroom floor.

**Qi’s Solution**

Area = $10x \times 7x$

I will use the formula for the area of a rectangle, area = length \times width, to help me write an algebraic expression describing the area of my classroom. I know the length of my classroom can be represented by the expression $10x$ and the width can be represented by the expression $7x$. 

You will need

- a calculator
Reflecting

1. Give two examples of first-degree monomials.

2. When multiplying two first-degree monomials, can a variable in the product ever be raised to the third power? Explain.

Work with the Math

Example 2: Multiplying monomials

Multiply \(2xy \times 3x\).

Rebecca’s Solution

\[
\begin{align*}
2 \times 3 &= 6 & \text{First, I multiply the coefficients.} \\
x \times x &= x^2 & \text{Next, I multiply like variables, using the rule for multiplying monomials with like bases.} \\
\ \\
\end{align*}
\]

\(y\)  

\[
\begin{align*}
\text{Since only one term contains a } y\text{, I will leave that variable raised to the first power.} \\
\ \\
2xy \times 3x &= 6x^2y & \text{Finally, I combine my solutions to form the final product.}
\end{align*}
\]
A Checking
3. Multiply $5x \times 4x$.
4. Multiply $4xy \times 2yz$.

B Practising
5. State whether or not each of the following expressions is a first-degree monomial?
   a) $12x^2$
   b) $11xy$
   c) $12x$
   d) $-4abc$
   e) $5c$
   f) $320ab^2$
   g) $-2x$
   h) $4x^2$

6. Determine each product.
   a) $3x \times 6x$
   b) $-10x \times 18x$
   c) $42ab \times 15b$
   d) $20xyz \times 33x$
   e) $-45ab \times (-2a)$
   f) $120mn \times 50m$
   g) $44x \times (-25xy)$
   h) $410x \times 20xy$
   i) $29xz \times 37yz$
   j) $13x \times 13x$
   k) $55mn \times 50n$
   l) $74xy \times 80z$
   m) $320x \times 11xy$

7. A triangle has a base with length $4x$ and a height of $3y$. What is the area of the triangle?

8. A rectangle has dimensions $6r$ and $2t$. The two diagonals of the rectangle divide the rectangle into four triangles with equal area. What is the area of each of the four triangles?

9. A rectangular box has length $5a$ metres, depth $7b$ metres, and height $8c$ metres. If the box has been filled $\frac{3}{5}$ of the way with liquid, determine an expression for how much liquid has been put into the box.

C Extending
10. Determine each product.
   a) $-25xy \times 20x \times (-5xy)$
   b) $36y \times 30z \times 25xyz \times 22x$
   c) $4 \times 2xyz \times 7xz \times 5xy \times 8z$
   d) $-50ab \times 44b \times 101a$
   e) $62x \times 5y \times 33xy \times 2z$

11. Think about the product determined by starting with the variable $x$ and multiplying it by itself, then multiplying that product by $x$ again, and repeating this so that a total of 10 $x$’s have been used in the product. What do you think the product will be? Explain.

12. Based on your reasoning in question 11, state a general rule for determining the product when a monomial is multiplied by itself any number of times.