EXAMPLE 5 **Write a joint variation equation**

The variable z varies jointly with x and y. Also, $z = -75$ when $x = 3$ and $y = -5$. Write an equation that relates x, y, and z. Then find z when $x = 2$ and $y = 6$.

Solution

STEP 1 **Write** a general joint variation equation.

$z = axy$

STEP 2 **Use** the given values of z, x, and y to find the constant of variation a.

$-75 = a(3)(-5)$ **Substitute −75 for z, 3 for x, and −5 for y.**

$-75 = -15a$ **Simplify.**

$5 = a$ **Solve for a.**

STEP 3 **Rewrite** the joint variation equation with the value of a from Step 2.

$z = 5xy$

STEP 4 **Calculate** z when $x = 2$ and $y = 6$ using substitution.

$z = 5xy = 5(2)(6) = 60$

EXAMPLE 6 **Compare different types of variation**

Write an equation for the given relationship.

Relationship	Equation
a. y varies inversely with x.	$y = \dfrac{a}{x}$
b. z varies jointly with x, y, and r.	$z = axyr$
c. y varies inversely with the square of x.	$y = \dfrac{a}{x^2}$
d. z varies directly with y and inversely with x.	$z = \dfrac{ay}{x}$
e. x varies jointly with t and r and inversely with s.	$x = \dfrac{atr}{s}$

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✓ **GUIDED PRACTICE**   **for Examples 5 and 6**

The variable z varies jointly with x and y. Use the given values to write an equation relating x, y, and z. Then find z when $x = -2$ and $y = 5$.

9. $x = 1$, $y = 2$, $z = 7$ **10.** $x = 4$, $y = -3$, $z = 24$

11. $x = -2$, $y = 6$, $z = 18$ **12.** $x = -6$, $y = -4$, $z = 56$

Write an equation for the given relationship.

13. x varies inversely with y and directly with w.

14. p varies jointly with q and r and inversely with s.