

State the domain and range of each relation. Then determine whether each relation is a function. Write *yes* or *no*.

1.  $\{(2, 7), (3, 10), (1, 6)\}$

2.  $\{(-6, 0), (5, 5), (9, -2), (-2, -9)\}$

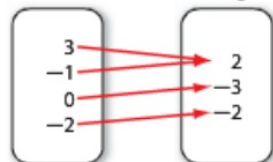
3.  $D = \{1, 2\}, R = \{5, 7, 9\};$  no

x	y
1	5
2	7
1	9

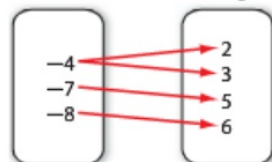
4.  $D = \{-12, -10, -8, -6\}, R = \{0, 1, 2, 4\};$  yes

x	y
-12	0
-10	1
-8	2
-6	4

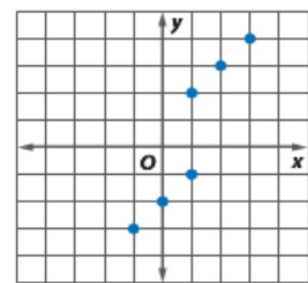
5. Domain:  $\{-2, -1, 0, 3\}$ , Range:  $\{-3, -2, 2\};$  yes



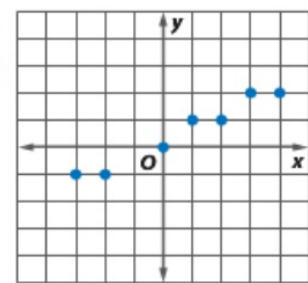
6. Domain:  $\{-8, -7, -4\}$ , Range:  $\{2, 3, 5, 6\};$  no



7.  $D = \{-1, 0, 1, 2, 3\}, R = \{-3, -2, -1, 2, 3, 4\};$  no



8.  $D = \{-3, -2, 0, 1, 2, 3, 4\}, R = \{-1, 0, 1, 2\};$  yes



Name the quadrant in which each point is located.

9.  $(5, 3)$  I

10.  $(8, -6)$  IV

11.  $(2, 0)$  none

12.  $(-7, -1)$  III



## Exercises

Find each product.

1.  $(a + 2)(a + 4)$   $a^2 + 6a + 8$

3.  $(h + 4)(h - 4)$   $h^2 - 16$

5.  $(b + 4)(b - 3)$   $b^2 + b - 12$

7.  $(r + 3)(r - 8)$   $r^2 - 5r - 24$

9.  $(p + 8)(p + 8)$   $p^2 + 16p + 64$

11.  $(2c + 1)(c - 5)$   $2c^2 - 9c - 5$

13.  $(3m + 4)(2m - 5)$   $6m^2 - 7m - 20$

15.  $(2q - 17)(q + 2)$   $2q^2 - 13q - 34$

2.  $(v - 7)(v - 1)$   $v^2 - 8v + 7$

4.  $(d - 1)(d + 1)$   $d^2 - 1$

6.  $(t - 9)(t + 11)$   $t^2 + 2t - 99$

8.  $(k - 2)(k + 5)$   $k^2 + 3k - 10$

10.  $(x - 15)(x - 15)$   $x^2 - 30x + 225$

12.  $(7n - 2)(n + 3)$   $7n^2 + 19n - 6$

14.  $(5g + 1)(6g + 9)$   $30g^2 + 51g + 9$

16.  $(4t - 7)(3t - 12)$   $12t^2 - 69t + 84$

17. **NUMBERS** I am thinking of two integers. One is 7 less than a number, and the other is 2 greater than the same number.

a. Write expressions for the two numbers.  $n - 7, n + 2$

13.  $(3m + 4)(2m - 5)$   $6m^2 - 7m - 20$

	$3m$	$4$
$2m$	$6m^2$	$8m$
$-5$	$-15m$	$-20$

### Example 4 Use Special Products

Factor each polynomial.

a.  $4x^2 + 20x + 25$

The first and last terms are perfect squares.  
The middle term is equal to  $2(2x)(5)$ .  
This is a perfect square trinomial of the form  $(a + b)^2$ .

$$4x^2 + 20x + 25 = (2x)^2 + 2(2x)(5) + 5^2$$

Write as  $a^2 + 2ab + b^2$ .  
Factor using the pattern.

$$= (2x + 5)^2$$

b.  $x^2 - 4$

This is a difference of squares.

$$x^2 - 4 = x^2 - (2)^2$$

Write in the form  $a^2 - b^2$ .  
Factor the difference of squares.

$$= (x + 2)(x - 2)$$

$a^2 - b^2$

$4(9y^2 - 4)$

5.  $(y + 3)(y + 9)$

7.  $(3y + 1)(y + 4)$

8.  $(7x + 2)(x + 7)$

9.  $(3x + 4)(x + 8)$

10.  $(x - 3)(x - 2)$

11.  $(y - 4)(y - 1)$

12.  $(3x - 5)(2x - 1)$

13.  $2(3a - b)(a - 8b)$

14.  $(11x - 1)(x - 7)$

15.  $(2x - 3y)(9x - 2y)$

18.  $(2a + 3b)^2$

19.  $(x + 12)(x - 12)$

20.  $(2c + 3)(2c - 3)$

### Exercises

Factor each polynomial.

1.  $12x^2 + 4x$   $4x(3x + 1)$

2.  $6x^2y + 2x$   $2x(3xy + 1)$

3.  $8ab^2 - 12ab$   $4ab(2b - 3)$

4.  $x^2 + 5x + 4$   $(x + 1)(x + 4)$

5.  $y^2 + 12y + 27$

6.  $x^2 + 6x + 8$   $(x + 2)(x + 4)$

7.  $3y^2 + 13y + 4$

8.  $7x^2 + 51x + 14$

9.  $3x^2 + 28x + 32$

10.  $x^2 - 5x + 6$

11.  $y^2 - 5y + 4$

12.  $6x^2 - 13x + 5$

13.  $6a^2 - 50ab + 16b^2$

14.  $11x^2 - 78x + 7$

15.  $18x^2 - 31xy + 6y^2$

16.  $x^2 + 4xy + 4y^2$   $(x + 2y)^2$

17.  $9x^2 - 24x + 16$   $(3x - 4)^2$

18.  $4a^2 + 12ab + 9b^2$

19.  $x^2 - 144$

20.  $4c^2 - 9$

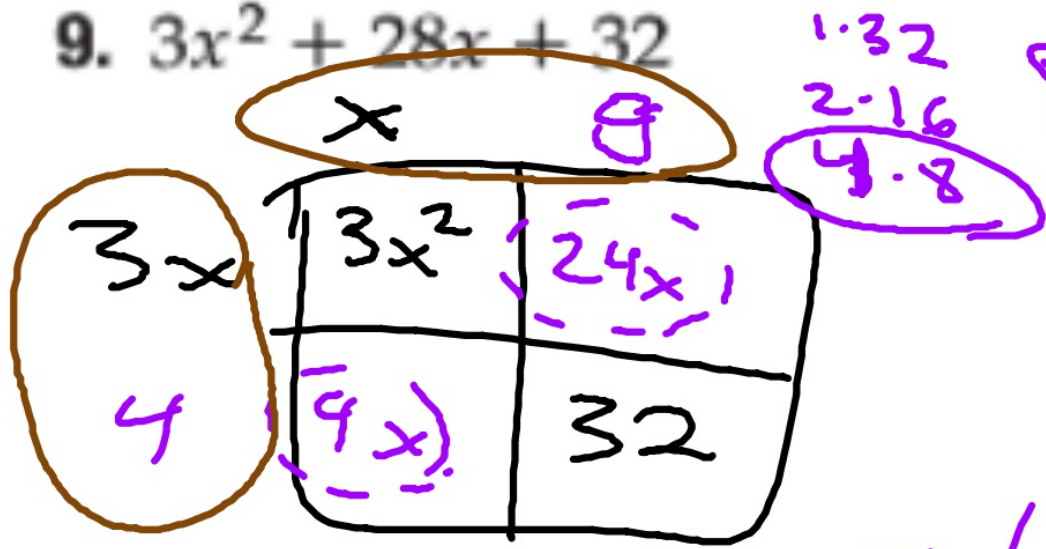
21.  $16y^2 - 1$   $(4y + 1)(4y - 1)$

22.  $25x^2 - 4y^2$   
 $(5x + 2y)(5x - 2y)$

23.  $36y^2 - 16$   
 $4(3y + 2)(3y - 2)$

24.  $9a^2 - 49b^2$   
 $(3a + 7b)(3a - 7b)$

9.  $3x^2 + 28x + 32$



Guess ...

.... and check!

$$4x + 24x = 28x \checkmark$$



9.  $(3x + 4)(x + 8)$

6.  $x^2 + 6x + 8$   $(x + 2)(x + 4)$