

4-1

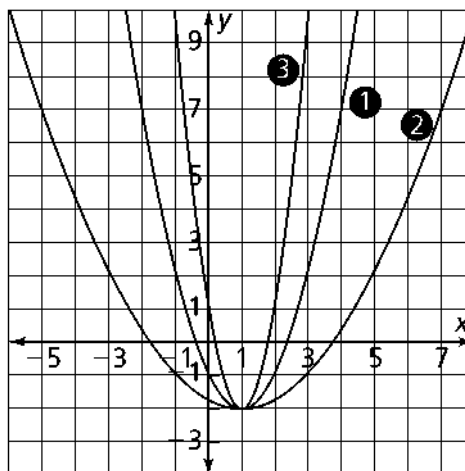
Activity: Sharing Vertices

Quadratic Functions and Transformations

This is an activity that can be done alone or in groups of two or three students. Your teacher may discuss each group's results once everyone has finished.

- Twelve different quadratic functions are given below.
- Your job is to find 4 sets of 3 functions that have the same vertex.
- Fill in your results at the bottom of the page and then check each set using a graphing calculator.

By graphing the following three functions, you can see that they share a common vertex (1, -2). Thus, they form a set.



Example Set

Vertex: (1, -2)

$$y = x^2 - 2x - 1$$

$$y = \frac{1}{4}x^2 - \frac{1}{2}x - \frac{7}{4}$$

$$y = 3x^2 - 6x + 1$$

1. $y = x^2 + 6x + 11$

2. $y = x^2 - 4x + 1$

3. $y = -3x^2 + 12x - 9$

4. $y = -\frac{1}{4}x^2 - \frac{3}{2}x - \frac{17}{4}$

5. $y = -3x^2 - 18x - 29$

6. $y = \frac{1}{4}x^2 + \frac{3}{2}x + \frac{17}{4}$

7. $y = \frac{1}{4}x^2 - x - 2$

8. $y = -x^2 + 4x - 1$

9. $y = -\frac{1}{4}x^2 + x + 2$

10. $y = -x^2 - 6x - 11$

11. $y = 3x^2 + 18x + 29$

12. $y = 3x^2 - 12x + 9$

Set A

Vertex:

Set B

Vertex:

Set C

Vertex:

Set D

Vertex:

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Activity: Decoding Device

Standard Form of a Quadratic Function

This is an activity that can be done alone or in groups of two or three students. Your teacher may wish to discuss each group's results once everyone has finished.

- Using standard form $y = ax^2 + bx + c$ and vertex form $y = a(x - h)^2 + k$, identify the ordered pairs in Exercises 1–14 below.
- Simplify fractions for the correct numerator (num.) and denominator (den.).
- Find the letter corresponding to the ordered pairs using the table at the right. For example, if your result is $y = 2x^2 + 7x + 9$, then $(a, c) = (2, 9) \rightarrow G$.
- Fill in the letters to find the name of a cryptographic device invented by an ancient Greek scholar.

	0	1	2	3	4	5	6	7	8	9
0	A	A	M	E	S	N	B	K	U	D
1	U	G	B	O	C	W	F	S	I	Q
2	Q	E	X	P	J	N	R	L	O	G
3	H	X	B	U	M	H	Y	B	X	Q
4	T	C	V	N	A	Y	R	T	E	K
5	J	V	I	S	W	R	F	M	X	P
6	V	B	I	G	R	Z	P	U	V	J
7	N	F	W	L	Y	U	Z	Q	U	L
8	Y	P	S	Z	O	M	J	Z	A	Y
9	L	K	A	H	L	U	H	Q	S	C

1 2 3 4 5 6 7 8 9 10 11 12 13 14

Convert to Standard Form

- $y = 5(x + 3)^2 - 36$; (a, c)
- $y = \left(x + \frac{3}{2}\right)^2 - \frac{1}{4}$; (a, b)
- $y = x(x + 3) + 6x$; (b, c)
- $y = 3[x(x - 5) + 2]$; (a, c)
- $y = 2x\left(\frac{1}{2}x + \frac{3}{4}\right) - 2 \cdot 3$; (num. b ; den. b)
- $y = 2x\left(x + 3 - \frac{4}{5}x\right) - 5x$; (den. a ; num. a)
- $y = 3\left[x(x - 5) + \frac{2}{7}\right]$; (num. c ; den. c)
- $y = \frac{1}{8}(3x + 2)(3x + 4)$; (num. a ; den. a)

Convert to Vertex Form

- $y = x^2 - 16x + 66$; (h, k)
- $y = x^2 - 2x + 10$; (h, k)
- $y = 2x^2 - 28x + 106$; (h, k)
- $y = -3x^2 + 1$; (h, k)
- $y = \frac{1}{3}x^2 - \frac{10}{3}x + \frac{40}{3}$; (h, k)
- $y = -\frac{1}{5}x^2 + \frac{8}{5}x + \frac{24}{5}$; (h, k)

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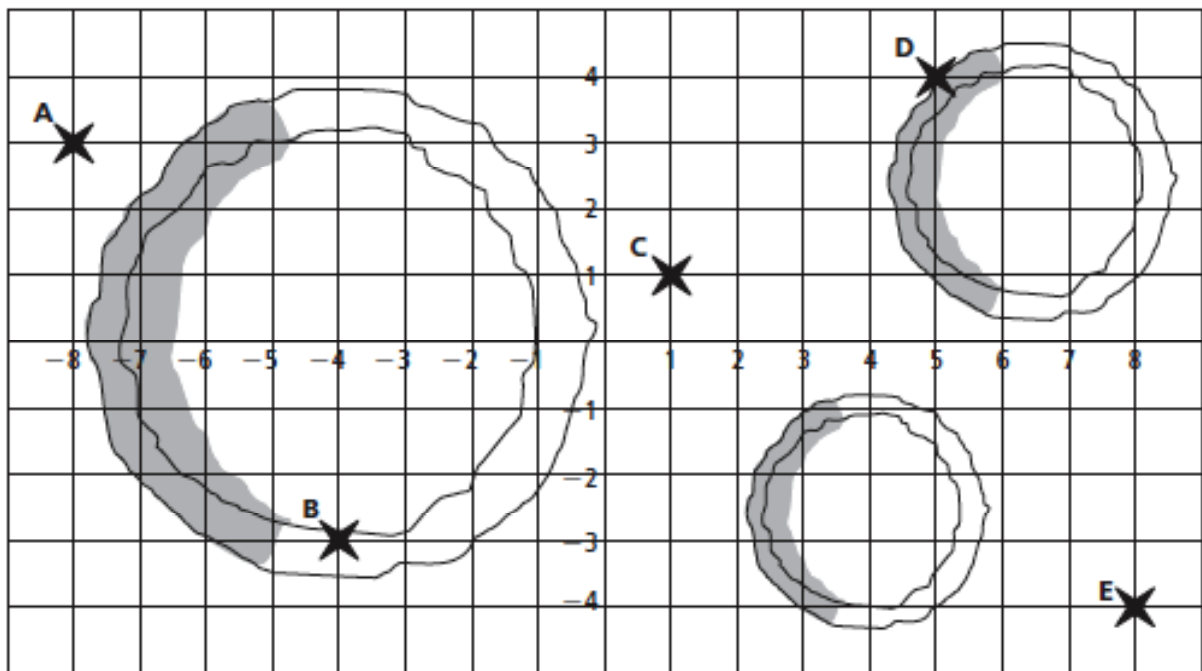
Activity: Flight Path

Modeling With Quadratic Functions

This is an activity for groups of two to four students. You will need a graphing calculator.

A spacecraft is going to a distant planet to collect and transmit data to the scientists at mission control. The figure below represents an overhead view of a region of interest on the surface of the planet. The five stars in the figure mark specific locations from which scientists want to receive data.

The spacecraft will take a flight path that must be parabolic and passes over exactly three of the targeted areas. There are ten different flight paths that pass over three of the points. Find the ten equations that model these flight paths. Round your answers to the nearest hundredth.



- | | |
|----|-----|
| 1. | 2. |
| 3. | 4. |
| 5. | 6. |
| 7. | 8. |
| 9. | 10. |

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Game: Factor This!

Factoring Quadratic Expressions

Game Play

This is a game for four students separated into two teams. Each team begins by secretly developing eight factorable polynomial expressions and writing them in standard form at the bottom of the page. Teams exchange pages and attempt to factor the opponent's functions. Then they write the factored form next to each function.

Rules

You must have two of each of the following types of polynomials.

- A.** the binomial factors have all integer coefficients and terms, and the leading coefficient equals 1
Example: $(x + 2)(x - 7) = x^2 - 5x - 14$
- B.** the binomial factors have all integer coefficients and terms, and one of the factors has leading coefficient *not* equal to 1
Example: $(2x + 1)(x - 3) = 2x^2 - 5x - 3$
- C.** the binomial factors have all integer coefficients and terms, and both of the factors have leading coefficients *not* equal to 1
Example: $(3x - 2)(2x - 9) = 6x^2 - 31x + 18$
- D.** the binomial factors have fractional coefficients and terms, and one of the factors has leading coefficient equal to 1 and all numerators equal 1
Example: $\left(x - \frac{1}{7}\right)\left(\frac{1}{3}x + \frac{1}{5}\right) = \frac{1}{3}x^2 + \frac{16}{105}x - \frac{1}{35}$

For each factor, all integer coefficients and terms must be between -10 and 10, and fractions must have numerators equal to 1 and denominators between -7 and 7.

The team that earns the most points wins.

Scoring

Correctly factoring:

- Type A — 1 point each
- Type B — 2 points each
- Type C — 3 points each
- Type D — 4 points each

Other

- Stumping your opponent — 1 point per function
- Correctly identifying the opponent's function as unfactorable — 5 points

- 1.
- 3.
- 5.
- 7.

- 2.
- 4.
- 6.
- 8.