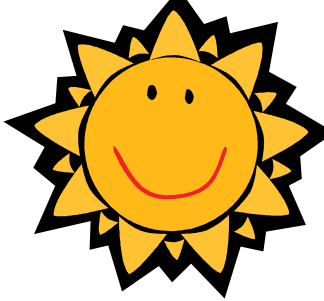
Unit 2 Day 3

Finding Extrema of Quadratic Functions

Warm Up



1. Factor the following. Then solve.

a. $x^2 - 5x + 50 = 0$ prime

b. $x^2 + 3x = 10$ Factors: $(x + 5)(x - 2) = 0$
Solutions: $x = -5, 2$

c. $2x^2 + 7x = -3$ Factors: $(x + 3)(2x + 1) = 0$
Solutions: $x = -3, -1/2$

2. Factor to solve the following:

a. $x^2 + 2x - 35 = 0$ $(x + 7)(x - 5) = 0$
$x = -7, 5$

b. $2x^2 + x = 3$ $(2x + 3)(x - 1) = 0$
$x = -3/2, 1$

c. $3x^2 + 10x = 8$ $(x + 4)(3x - 2) = 0$
$x = -4, 2/3$

Packet Homework Answers
(YOU ONLY HAD EVENS)

1.) n= 2/3, -1/4

2.) m = 0, 3

3.) n = 1/5, -1

4.) n = 1/2, 8

5.) k = 3, 8

6.) n = -3, -6

7.) v = -6, 1

8.) k = -2 (double root)

9.) v = 4, 3

10.) n = 2, -8

Packet Homework Answers

11.) r = -1, -2

12.) b = -2, 1

13.) n = 7, -1/2

14.) x = 4, -4/3

15.) n = 7, 1/8

16.) n = -4/7, -6

17.) a = -5/7, -5

18.) x = 4/7, 7/5

19) x = 0, 4

20) x = 0, -2, -5

21) $x = 2\sqrt{14}, -2\sqrt{14}$

22) x = 4i, -4i

23) $x = 6\sqrt{2}, -6\sqrt{2}$

24) x = 3i, -3i

Notes p. 6 Answers

1. $x^2 + 5x - 24 = 0$

$x = -8, 3$

2. $x^2 - 3x - 28 = 0$

$x = 7, -4$

3. $3x^2 + 16x - 12 = 0$

$x = -6, \frac{2}{3}$

4. $4x^2 + 3x = 0$

$x = 0, \frac{-3}{4}$

5. $4x^2 + 7x - 2 = 0$

$x = \frac{1}{4}, -2$

6. $9x^2 + 30x + 24 = 0$

$x = \frac{-4}{3}, -2$

7. $24x^2 + 132x = 0$

$x = 0, \frac{-11}{2}$

Notes p. 6 Answers

8. $x^2 = 81$

$x = 9, -9$

9. $x^2 = 25$

$x = 5, -5$

10. $5x^2 - 20 = 0$

$x = 2, -2$

11. $5x^2 + 5 = 0$

$x = i, -i$

12. $6x^2 - 72 = 0$

$x = \pm\sqrt{12} = \pm 2\sqrt{3}$

13. $3x^2 - 9 = 0$

$x = \sqrt{3}, -\sqrt{3}$

14. $2x^2 + 72 = 0$

$x = 6i, -6i$

Homework

- Packet p. 4
- Study for Quiz!

Finding Extrema using Zeros

Notes p. 7-8

HINT: for the graph on p. 8, you must use different units for each axis!

Show Investigation Notes pages on document camera when reviewing with class.

Notes p. 7- Check your answers!

Given the following trinomials, factor each to find the zeros:

1. $x^2 + 8x + 15 = 0$ 2. $x^2 - 13x + 42 = 0$ 3. $x^2 + 2x – 24=0$

Polynomial	Factors	Zeros	Average of the Zeros
$x^2 + 8x + 15 = 0$	$(x+3)(x+5) = 0$	(-3, 0), (-5, 0)	-4
$x^2 - 13x + 42 = 0$	$(x-7)(x-6) = 0$	(7, 0), (6, 0)	6.5
$x^2 + 2x – 24=0$	$(x+6)(x-4) = 0$	(-6, 0), (4, 0)	-1

Notes p. 7

$$x^2 - 2x - 35 = 0$$

$$(x+5)(x-7) = 0$$

$$x+5=0 \qquad x-7=0$$

$$x = -5,\ x = 7$$

- $$\frac{-5+7}{2} = 1$$

$$x = 1$$

- **To find the zeros:**
  - **Set the expression = 0 first!**
  - **Factor**
  - **Set each factor = 0 and solve!**

- **To find the vertex (the maximum or the minimum):**

-Average the zeros to find the x-value.

- Substitute the x-value into the original polynomial to find y-value

Our x – value for the minimum was x = 1. So we'll substitute the 1 in for x in our original polynomial.

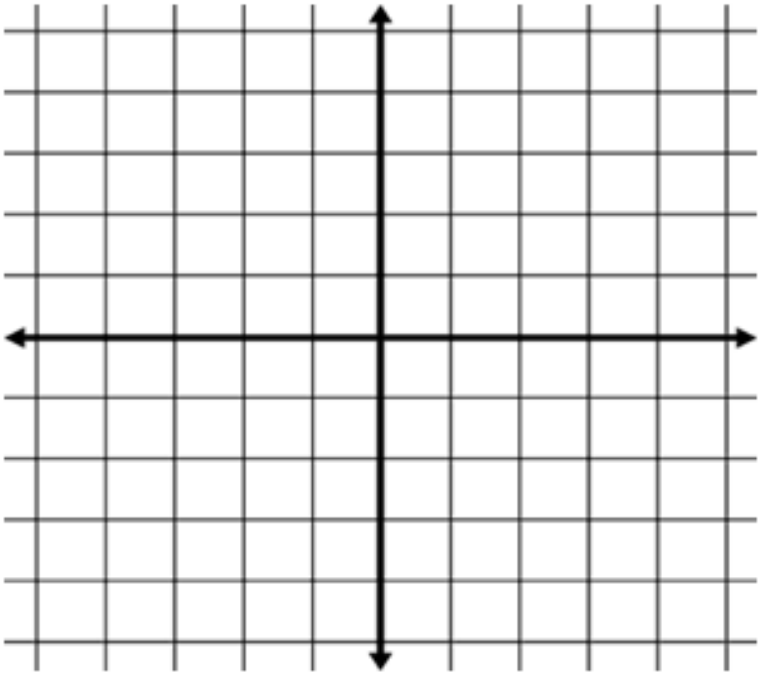
$(1)^2 - 2(1) - 35 = 1 - 2 - 35 = -36$

So our vertex, or minimum, is (1, -36)

To find a fourth point, substitute x = 0 into the polynomial.

$(0)^2 - 2(0) - 35 = -35$

Y-intercept = (0, -35)



Graph the four points from above with a smooth curve.

Remember to plot

*the zeros (-5, 0) and (7, 0)

*the vertex (1, -36)

*the y-intercept (0, -35)

*a 5th point -> see below!

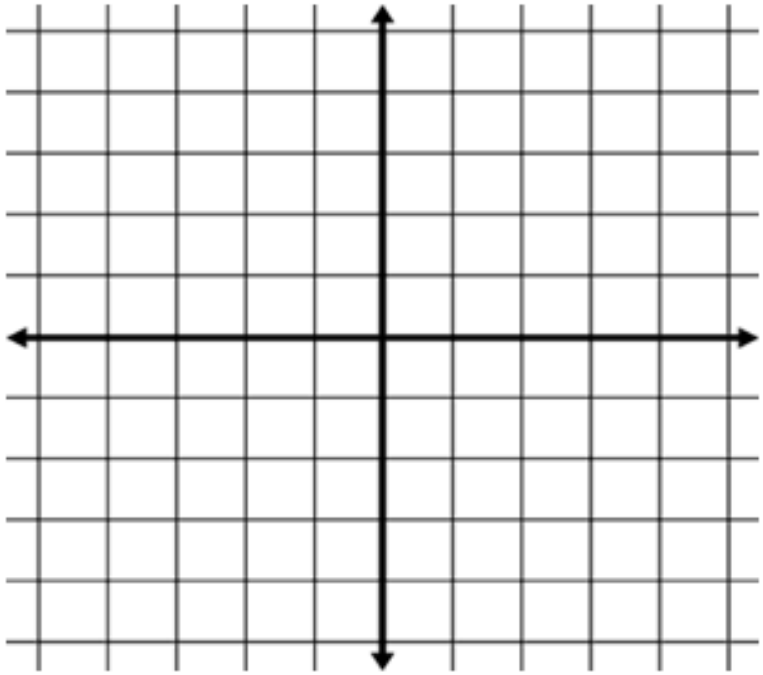
HINT: for the graph, you must use different units for each axis! (like 2 on the x-axis, 10 on the y-axis)

Use your fourth point AND your knowledge of reflections & symmetry from Unit 1 for a fifth point.

Without using a calculator, these steps will make sketching a graph much easier! ☺

What appears to be the line of symmetry on the graph?

x = 1



***Axis of symmetry: a line that divides a parabola into 2 parts that are mirror images**

(can be abbreviated A.o.S.)

****It's a line…so remember to write a line <u>equation</u> NOT just a number!**

How do we know if our vertex is a maximum or a minimum?

- **Remember, a minimum is the lowest point on a graph.**
- **A maximum is the highest point on a graph.**

Axis of Symmetry

1. Write your equation in Standard Form: $y = ax^2 + bx + c$

2. Find values of a, b, and c and use formula: $x = \frac{-b}{2a}$

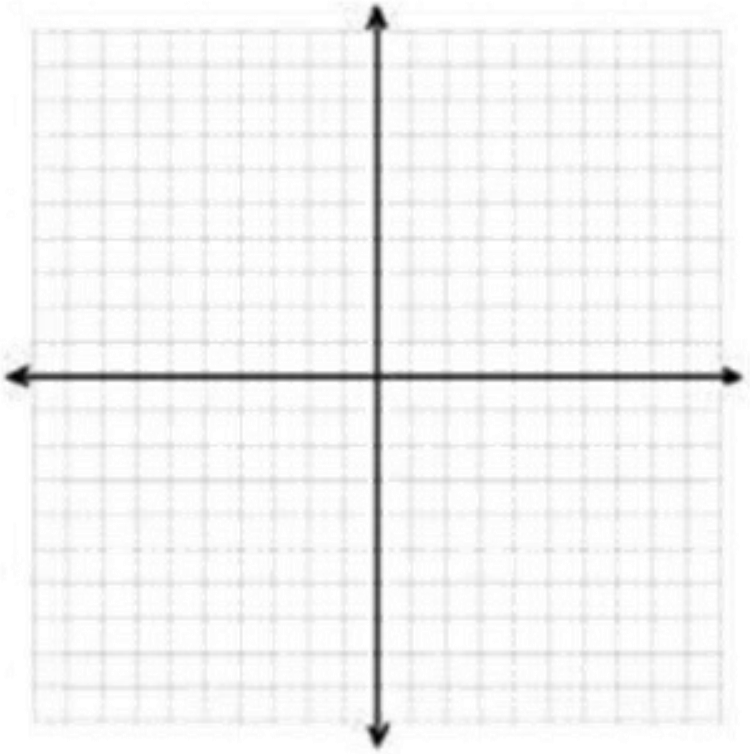
Example: $y = x^2 - 2x - 35$, so a = 1, b = -2, and c = -35.

Then use $x = \frac{-b}{2a} = \frac{-(-2)}{2(1)}$ Axis of Symmetry is x = 1.

***Don't forget to substitute this x-value into the original equation to find the y-value of the vertex!**

Let's try another one: Graph $y = x^2 + 2x - 8$

Polynomial	y – intercept	Zeros	Vertex
$x^2 + 2x - 8$	(0,-8)	(-4,0) (2,0)	(-1, -9)



Is the vertex of $y = x^2 + 2x - 8$ a minimum or maximum?

minimum

What is the Axis of Symmetry?

x = -1

Key Details: (Notes p. 8)

To write zeros as x-intercepts, write a coordinate pair.

What should the y-value be for an x-intercept?

Zero! ☺

For a 4^{th} and 5^{th} point, use the y-intercept and the "y-intercept mirror" (the reflection of the y-intercept over the axis of symmetry)

Always graph AT LEAST 5 points and make a smooth curve!
Pick other points besides our typical 5 points, if needed.

Direction of parabolas discovery

Notes p. 8

Check your answers with your partner THEN discuss patterns. ☺

Show Investigation Notes pages on document camera when reviewing with class.

Notes p. 8 ANSWERS

Function	Parabola opens up or down?
1. $y = x^2 + 3x + 4$	Up
2. $y = x^2 + 3x - 4$	Up
3. $y = -x^2 + 3x + 4$	Down
4. $y = x^2 - 4$	Up
5. $y = -x^2 + 4$	Down
6. $y = -x^2 - 4$	Down
7. $y = -x^2 + 3x$	Down
8. $y = x^2 - 5x - 2$	Up
9. $y = -x^2 - 5x - 2$	Down

Summary!

What determines if the parabola opens up or down??

If $a > 0$ then the parabola opens up
If $a < 0$ then the parabola opens down.

How do we know if our vertex is a maximum or a minimum?

- **If $a > 0$ then the parabola opens up,**
  Remember $a > 0$ means a is positive
  It's a "smile" parabola, so vertex is minimum ☺

- **If $a < 0$ then the parabola opens down**
  Remember $a < 0$ means a is negative
  It's a "frown" parabola, so vertex is maximum ☹

Musical Chairs
Notes p. 18-19
(at back of Notes Packet)
No calculators allowed!

*You will be put in groups and I will tell you where to start

*Once you are finished with your first question, rotate to the next question on your right (clockwise)

Musical Chairs #1

$$y = x^2 + 4x + 3$$

Musical Chairs #2

$$y = 2x^2 + 2x$$

Musical Chairs #3

$$y = -x^2 - 2x + 8$$

Musical Chairs #4

$$y = 2x^2 + 6x + 4$$

Musical Chairs #5

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

Homework

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