Period 7

A2.A.REI.D.6 (formerly A-REI.D.11) Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x), find the approximate solutions using technology
A2.F.BF.A.1 Write a function that describes a relationship between two quantities
A2.F.BF.A.1a Determine an explicit expression, a recursive process, or steps for calculation from a context
A2.F.BF.A.1b Combine standard function types using arithmetic operations.

4-1 Quadratic Functions and Equations

Objectives: Students will graph quadratic functions using the transformations from the parent function $y=x^2$. Students will create the functions from the given graph in vertex form $y = a(x-h)^2 + k$. Students will use calculators to graph the functions and use the vertex to answer real life questions.

Warm up

1. If $f(x) = -2(x-1)^2$, find $f(-3)$
2. Determine the transformations of $y = -|x+1| - 2$ and sketch the function

Key Concepts

quadratic f. - a function that can be written in the standard form $f(x) = ax^2 + bx + c$, where $a \neq 0$

parabola - the graph of a quadratic function a(+) a(-)

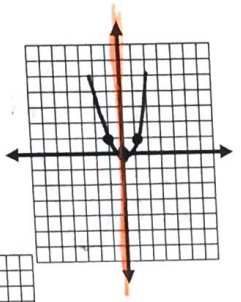
$y = a(x-h)^2 + k$ - a form of a parabola where and (h, k) is the vertex

vertex form

Examples

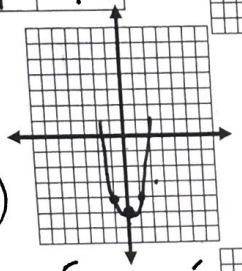
1. Graph $f(x) = x^2$ PARENT FUNCTION

x	f(x)
0	0
1	1
-1	1



a. Identify the vertex. (0,0)
b. Identify the axis of symmetry. x=0
c. Identify the maximum or minimum value. y=0

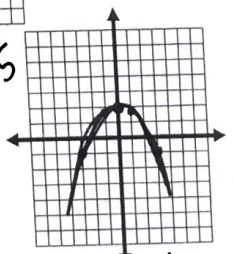
2. Graph the translation $f(x) = x^2 - 5$



a. Identify the vertex. Is it a maximum or minimum?
b. Identify the axis of symmetry. (0,-5) x=0
c. State the maximum or minimum value. y=-5
d. Describe how the graph a translation of the parent function $y = x^2$ DOWN 5

a=1/1

3. Graph the transformation $g(x) = -\frac{1}{3}x^2 + 2$



a. Identify the vertex. Is it a maximum or minimum? (0,2)
b. Identify the axis of symmetry. x=0
c. Describe how the graph is a transformation of the parent function $y = x^2$

$a = -\frac{1}{3}$ 1

plug in numbers to get additional pts if needed

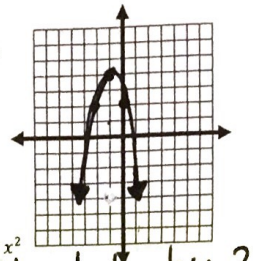
x	3	-3
y	-1	-1

$-\frac{1}{3}(3)^2 + 2$

$-3 + 2 = -1$

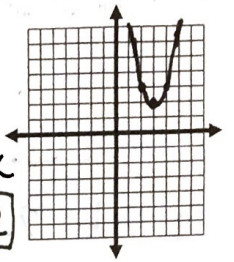
change sign

4. Graph the transformation $g(x) = -2(x+1)^2 + 4$



a. Identify the vertex. Is it a maximum or minimum? (-1,4) a=-2/1 MAX
b. Identify the axis of symmetry. x=-1
c. What is the minimum or maximum value? y=4
d. Describe how the graph a translation of the parent function $y = x^2$ L 1, up 4, reflection, stretch by 2
e. State the domain and range of the function. D(-∞,∞) R(-∞,4]

5. Write an equation to model the graph.



vertex (3,2) h k a = 1/1 = 1

$y = a(x-h)^2 + k$

$y = (x-3)^2 + 2$

6. **Workbook page 85 question #5 group activity**

use calculator to graph the function and find the maximum point (ordered pair x and y) then answer the questions

Calculator steps to graph: Menu 5, enter function/use x for t and y for h, press enter or F6 to graph, press F5 (G-Solv) and find max or min (depending on what's given in the problem)

a) b)

Workbook page 85 MINI WHITE BOARD ACTIVITY

1) 2) 3) 4)

Extra credit/Early Finishers THINK ABOUT A PLAN in workbook page 82

Exit ticket use the slips in your baskets and submit on your way out.

Graph a function $y = -2(x-5)^2 - 1$

Please do not forget to clean up after yourselves, and place all calculators and materials in the basket

A2.A.RELD.6 (formerly A-REI.D.11) Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x), find the approximate solutions using technology

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4-2 Standard Form of a Quadratic Function

Objectives: Students will graph functions in standard form of a quadratic equation. Students will convert functions from standard form to vertex form and vice versa. Students will solve the vertex and use it to describe real life scenarios.

Warm up

1. What is the vertex of a function $y = -(x+5)^2 - 11$? REFLECTION $(-5, -11)$
2. Multiply binomials $(x+2)(x-3)$

Key Concepts

Standard form $y = ax^2 + bx + c$

axis of symmetry $x = \frac{-b}{2a}$

vertex $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

y-intercept is $(0, c)$.

Examples

1. Graph the function $y = x^2 + 2x + 3$

Step 1: Identify a, b, & c.

$a = 1 \quad b = 2 \quad c = 3$

Step 2: Graph the axis of symmetry.

$x = \frac{-b}{2a} = \frac{-2}{2 \cdot 1} = \frac{-2}{2} = -1$

Step 3: Find the vertex. $(-1, 2)$

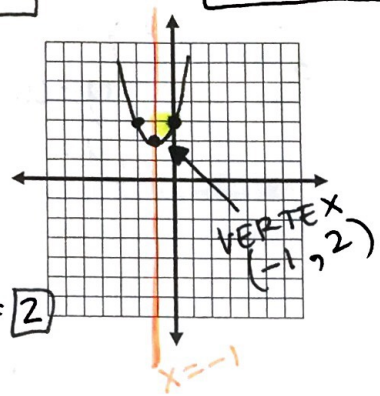
$y = x^2 + 2x + 3$

$(-1)^2 + 2(-1) + 3 = 1 - 2 + 3 = 2$

Step 4: Plot the y-intercept and its reflection.

$(0, c) = (0, 3)$

Step 5: Draw the graph through the points.



2. Graph the function $y = x^2 - 4x - 4$

step1 $a = 1 \quad b = -4 \quad c = -4$

step2 $x = \frac{-b}{2a} = \frac{4}{2 \cdot 1} = 2$

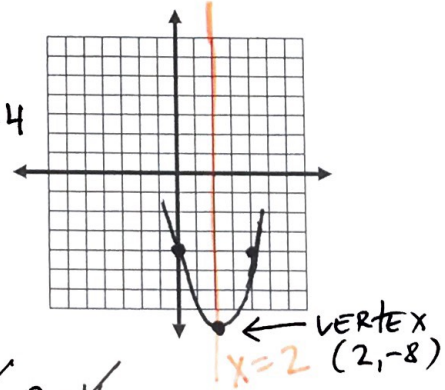
step3 $(2, -8)$

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

$2^2 - 4 \cdot 2 - 4 = 4 - 8 - 4$

$= -8$

step4 y-int $(0, c) = (0, -4)$



3. Convert $y = -x^2 + 4x - 5$ to vertex form, then convert it back to standard form

$y = ax^2 + bx + c \rightarrow y = a(x-h)^2 + k$

$a = -1 \quad b = 4 \quad c = -5$

VERTEX $x = \frac{-b}{2a} = \frac{-4}{2(-1)} = \frac{-4}{-2} = 2$

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

$y = -2^2 + 4 \cdot 2 - 5 = -4 + 8 - 5 = -1$

4. Convert $y = 2x^2 + 12x + 7$ to vertex form, then convert it back to standard form.

$a = 2 \quad b = 12 \quad c = 7$

$x = \frac{-b}{2a}$

$= \frac{-12}{2 \cdot 2} = \frac{-12}{4}$

$= -3 = h$

$y = 2x^2 + 12x + 7$

$y = 2(-3)^2 + 12(-3) + 7$

$18 - 36 + 7$

$-18 + 7$

$= -11$

$y = 2(x+3)^2 - 11$

5. **Workbook page 89 question 7**

Solve vertex by hand then use calculator to graph and find the vertex (to check your work). You may refer to the calculator steps from the previous lesson (question 6)

$C = 0.6p^2 - 7.2p + 48$

COST ↑ percent increase ↑ $p = ?$

$x = \frac{-b}{2a} = \frac{7.2}{2(0.6)}$

$= 6 = p$

$y = 0.6 \cdot 6^2 - 7.2 \cdot 6 + 48$

$= 26.4 = C$

MINIMIZE

THOUSANDS

Workbook page 89 MINI WHITE BOARD ACTIVITY

1) 2) 3) 4) 5) 6)

Extra credit/Early Finishers THINK ABOUT A PLAN in workbook page 86

Exit ticket use the slips in your baskets and submit on your way out.

Graph a function $y = -3x^2 + 6x - 1$

Please do not forget to clean up after yourselves, and place all calculators and materials in the basket

4-1 and 4-2 REVIEW 9/17

WARM UP

Graph $y = 2x^2 - 4x + 1$ and convert it to vertex form

USE GRAPH PAPER

$x = \frac{-b}{2a} = \frac{-(-4)}{2 \cdot 2} = \frac{4}{4} = \boxed{1}$

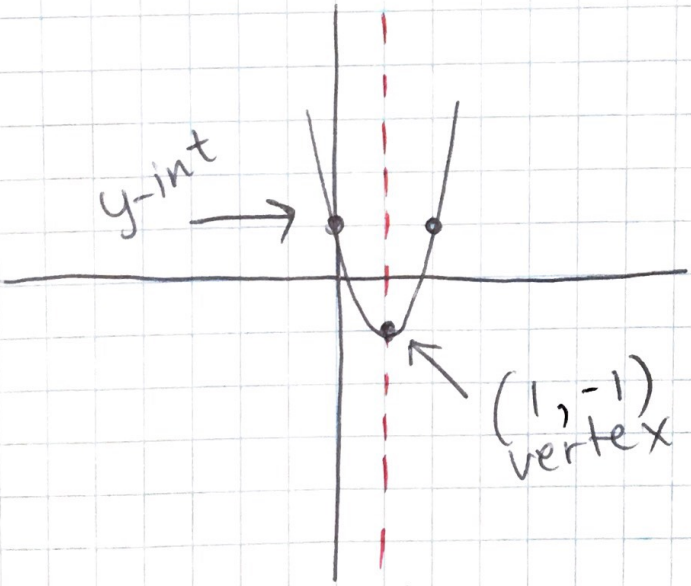
$(1, -1)$

$y = 2 \cdot 1^2 - 4 \cdot 1 + 1$

$2 - 4 + 1 = \boxed{-1}$

axis of symmetry $x = 1$

y-int $(0, c) = (0, 1)$



	x	-1
x	x^2	$-x$
-1	$-x$	$+1$

pg 85

vertex form

$y = a(x-h)^2 + k$

$\boxed{y = 2(x-1)^2 - 1}$

convert to the form $y = ax^2 + bx + c$ | it back standard

$y = 2(x-1)(x-1) - 1$

$y = 2(x^2 - 2x + 1) - 1$

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

$\boxed{y = 2x^2 - 4x + 1}$

(formerly A-CED.A.1) Create equations and inequalities in one variable and use them to solve problems. Include equations linear and quadratic functions, and simple rational and exponential functions

S.ID.6.a Represent data on two quantitative variables on a scatter plot and describe how the variables are related. Fit a function to the use functions fitted to data to solve problems in the context of the data

4-3 Modeling with Quadratic Functions

Objectives Students will create quadratic models (quadratic functions) to represent real world scenarios. Students will use these models to predict future values.

Warm up **CALCULATOR STEPS: MENU 2, ENTER NUMBERS, F2, F3, F1, F1**

Create a linear regression line model for the following table of values, where x represents month (Jan-1, Feb-2 etc) and y represent the price of milk per gallon during the given month.

x	1	2	3	4	5	6	7
y	$3.14	$2.95	$2.99	$3.09	$3.29	$3.20	$3.25

a) What's the correlation coefficient in this model? r = r=0.68 moderately strong

b) What is the linear model function/equation? y= 0.04X + 2.97 What price of milk should we expect in December? y=? X=12 y=0.04•12 +2.97 y = 3.45

c) Which month will we expect the price to be $3.40? x=? 3.40 = 0.04x + 2.97 x = 10.75 October

Examples

1. A parabola contains the points (0, 0), (-1, -2), and (1, 6). What is the equation of the parabola in standard form?

CALCULATOR STEPS: MENU 2, ENTER NUMBERS, F2, F3, [redacted], F3 y=2x²+4x

2. A player throws a basketball toward the hoop. The basketball follows a parabolic path through the points (2, 10), (4, 12), and (10, 12). Find a quadratic function to model this situation.

CALCULATOR STEPS: MENU 2, ENTER NUMBERS, F2, F3, [redacted], F3

3. The table shows a meteorologist's predicted temperatures for this particular day.

time	temperature
8am	52
10am	64
12pm	72
2pm	78
4pm	81
6pm	76

a) What is a quadratic model for the data?

b) Use your model to predict the highest temperature for the day. y=79

Workbook page 93 MINI WHITE BOARD ACTIVITY

3) 4)

5)

Extra credit/Early Finishers **THINK ABOUT A PLAN in workbook page 90**

Exit ticket **use the slips in your baskets and submit on your way out.**

Find an equation in standard form of the parabola passing through the points. (1, -3), (2, 0), (3, 9)

Please do not forget to clean up after yourselves, and place all calculators and materials in the basket

A2.A.REI.B.3 Solve quadratic equations and inequalities in one variable

Solve quadratic equations by inspection (e g , for x2 = 49), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b

4-4 Factoring Quadratic Expressions (Part 1)

Objectives: Students will factor quadratic expressions using GCF, grouping and rules for factoring when the leading coefficient is 1, and when leading coefficient is not 1.

Warm up What is the greatest common factor of numbers 45 and 36? Break each number into primes, then compare!

Key Concepts

factoring - rewriting an expression as the product of its factors. (un-distributing)

greatest common - the largest quantity that is a factor of all the integers or polynomials involved.

Examples factor GCF

1. Factor out the GCF.

   a. $-3x^2 - 15xy$ b. $6a^3 - 9a^2 + 12a$ c. $4x^2 - 20x + 24$

2. Factor out the GCF.

   a. $6(x + 2) - y(x + 2)$ b. $xy(y + 1) - (y + 1)$

3. Factor using grouping.

   a. $x^3 + 2x^2 - 3x - 6$ b. $h^3 + 2h^2 - 3h - 6$

4. Factor each expression (a = 1, or when the a value is the GCF to the entire expression).

   a. $x^2 + 9x + 20$ b. $x^2 + 14x - 72$ c. $-x^2 + 13x - 12$

5. Factor ($a \neq 1$, or when the a value **is not** the GCF to the entire expression)

   a. $2a^2 + 11a + 12$ b. $4x^2 - 4x - 3$ c. $5x^2 + 28x + 32$ d. $5x^2 - 13x + 6$

Workbook page 97 MINI WHITE BOARD ACTIVITY 1) **2)** **3)**

Extra credit/Early Finishers **THINK ABOUT A PLAN in workbook page 94**

Exit ticket **Factor $x^2 - 14x + 24$**

Please do not forget to clean up after yourselves, and place all calculators and materials in the basket

4-4 FACTORING PART 1 9/19/18

1) a) $-3x^2 - 15xy$

$-3 \cdot x \cdot x - 5 \cdot 3 \cdot x \cdot y$

$\boxed{-3x(x + 5y)}$

b) $6a^3 - 9a^2 + 12a$

$12 < 3, 2, 2$

$2 \cdot 3 \cdot a \cdot a \cdot a - 3 \cdot 3 \cdot a \cdot a + 2 \cdot 2 \cdot 3a$

$\boxed{3a(2a^2 - 3a + 4)}$

c) $4x^2 - 20x + 24$

$24 < 6 < 3, 2$ and $4 < 2, 2$

$2 \cdot 2 \cdot x \cdot x - 2 \cdot 2 \cdot 5x + 2 \cdot 2 \cdot 2 \cdot 3$

$\boxed{4(x^2 - 5x + 6)}$

2) a) $6 \cdot (x+2) - y \cdot (x+2)$

$\boxed{(x+2)(6-y)}$

b) $xy(y+1) - 1(y+1)$

$(y+1)(xy-1)$

GROUPING – 4 TERMS

3) a) $x^3 + 2x^2 - 3x - 6$

$x \cdot x \cdot x + 2 \cdot x \cdot x \quad -3 \cdot x \quad -3 \cdot 2$

$x^2(x+2) - 3(x+2)$

$$\boxed{(x+2)(x^2-3)}$$

4) a) $x^2 + 9x + 20$ $\quad a = 1$

$4 + 5 \qquad 4 \cdot 5$

$$\boxed{(x+4)(x+5)}$$

b) $x^2 + 14x - 72$

$18 + -4 \qquad 18 \cdot -4$

$$\boxed{(x+18)(x-4)}$$

$1 \cdot 72 = 72$
$2 \cdot 36 = 72$
$3 \cdot 24 = 72$
$4 \cdot 18 = 72$
$6 \cdot 12 = 72$
$8 \cdot 9 = 72$

c) $-x^2 + 13x - 12$

$-(x^2 - 13x + 12)$

$-1 + -12 \qquad -1 \cdot -12$

$$\boxed{-(x-1)(x-12)}$$

5) a) $2a^2 + 11a + 12$ $a \neq 1$ a is not a GCF

Method

"split the middle"

$2a^2 + 8a + 3a + 12$

$2a(a+4) + 3(a+4)$

$ac = 24$

$8 \cdot 3$

$\boxed{(a+4)(2a+3)}$

Method 2

"slip and slide"

$2a^2 + 11a + 12$

$* a^2 + 11a + 24$

$8 + 3 \quad 8 \cdot 3$

$* (a + \frac{8}{2})(a + \frac{3}{2})$

$\boxed{(a+4)(2a+3)}$

A2.A.REI.B.3 Solve quadratic equations and inequalities in one variable.
Solve quadratic equations by inspection (e g , for x2 = 49), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.

4-4 Factoring Quadratic Expressions (Part 2-special cases)

Objective: Students will factor perfect square trinomials and difference of squares (special cases)

Warm up

a) What are all possible ways to multiply two numbers and get 36? b) factor $4x^2+12x+9$

4
9
16
25
36
49
64
81
100
121
144
169
196
225

Key Concepts

Perfect Square Trinomials $(a+b)^2 = a^2+2ab+b^2$ and $(a-b)^2 = a^2-2ab+b^2$
Difference of Squares $a^2-b^2=(a-b)(a+b)$
Examples:

1. Factor
   a. $4x^2+12x+9$ b. $9x^2+30x+25$ c. $16x^2-80x+25$

$a^2+2ab+b^2$ $a=\sqrt{4a^2}=2a$ $b=\sqrt{9}=3$ $(2a+3)^2$

$a^2\ 2ab\ b^2$ $a=3x$ $b=5$ $2ab=2\cdot3x\cdot5=30x$ $(3x+5)^2$

$a=4x$ $b=5$ $2ab=2\cdot4x\cdot5=40x$ NOT a perfect square!

2. Factor using the difference of squares $a^2-b^2=$
   a. x^2-4 b. $4x^2-9$ c. $9x^2-36$

$a=x$ $b=2$ $(x-2)(x+2)$ $a=2x$ $b=3$ $(2x-3)(2x+3)$ $9(x^2-4)$ $9(x-2)(x+2)$

3. Suppose you hit a baseball and its flight takes parabolic path. The height of the ball at certain times appears in the table below

Times (s)	0.5	0.75	1	1.25
Height (ft)	10	10.5	9	5.5

a) Find the quadratic model for the ball's height as a function of time b) factor the function

MENU → 2 → F2(CALC) F3(REG) → F3 (x^2) $y=-16x^2+22x+3$ 1.48 2.24

$-(16x^2-22x-3)$

Workbook page 97 MINI WHITE BOARD ACTIVITY
4) 5) 7) $x^2-22x-48$ $(x+2)(x-24)$ $\frac{2}{16}$ $\frac{-24}{16}$

Extra credit/Early Finishers THINK ABOUT A PLAN in workbook page 94 $(x+\frac{1}{8})(x-\frac{3}{2})$

Exit ticket a) Factor $9x^2+12x+4$ b) Facor x^2-25

Please do not forget to clean up after yourselves, and place all calculators and materials in the basket

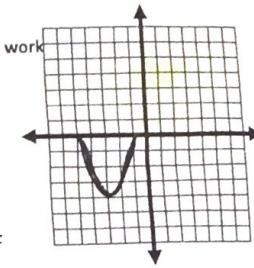
$(8x+1)(2x-3)$

homework 4-1: Complete your assignment on a separate sheet of GRAPH paper. Show all work.

1. Graph each function, describe the transformation, identify the vertex, axis of symmetry and maximum or minimum value.
   a. $y=-x^2$ b. $y=-x^2-7$ c. $y=(x+1)^2-4$
2. When does the graph of a quadratic function have a minimum value?
3. Describe the similarities and differences between the graphs of $y=-(x+6)^2-7$ and $y=(x+6)^2$

homework 4-2: Complete your assignment on a separate sheet of GRAPH paper. Show all work

1. Identify the vertex, axis of symmetry and maximum or minimum value for the parabola.



2. Graph $y=x^2-2x+4$
3. Graph, state the vertex, axis of symmetry, maximum or minimum and range.
   a. $y=x^2+2x+1$ b. $y=3x^2-4x-2$ c. $y=2x^2+4x$
4. A model for a company's revenue from selling a software package is $R=-2.5p^2-500p$, p is the pr of the software. What price would maximize revenue? What is the maximum revenue?

Homework 4-3 Complete your assignment on a separate sheet of paper. Show all work.

1. Find an equation in standard form of the parabola passing through the points. (3, -1), (2, -5), (4, -5)
2. A player hits a tennis ball across the court and records the height of the ball at different times, as shown in the table below.

Time (s)	Hei (f
0	5
1	6
2	5
3	4

   a. Find a quadratic model for the data.
   b. Use the model to estimate the height of the ball at 4 seconds.
   c. What is the ball's maximum height?

homework 4-4 Part 1: Complete your assignment on a separate sheet of paper. Show all work.

1. Find the GCF
   a. $15x^2-25x$ b. $21h^3+35h^2-28h$
2. Factor
   a. x^2+3x+2 b. $x^2+15x+36$ c. $-r^2+11r-1$
   d. $a^2-5a-14$ e. $a^2+10a-75$ f. $27p^2-9p+18$
3. Factor
   a. $3a^2+31a+36$ b. $7x^2-8x-12$

homework 4-4 Part 2: Complete your assignment on a separate sheet of paper. Show all work.

1. Factor
   a. $9x^2-1$ b. $64x^2-16$ c. $18h^3-8h$
   d. $x^2-18x+81$ e. $12x^2+36x+27$ f. $4x^2-22x+10$