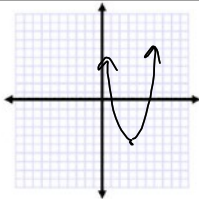
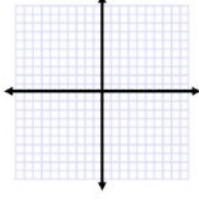
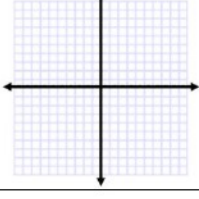
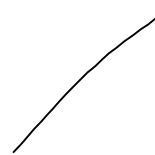
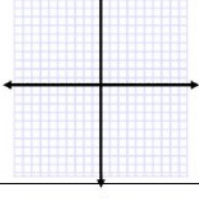
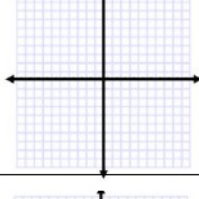
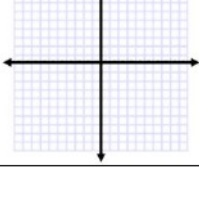
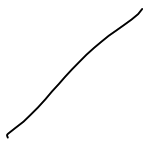


MPM2D

5.1 Investigation: Solving Quadratic Equations

Part A: Equations in Vertex Form

Use Desmos to complete the table.

Equation	Sketch	Vertex	Direction of opening	# of zeros	zeros
$y = 3(x-4)^2 - 5$		$(4, -5)$	UP	2	$(5.3, 0)$ $(2.7, 0)$
$y = 2(x-1)^2$		$(1, 0)$	UP	1	$(1, 0)$
$y = \frac{1}{2}(x+3)^2 + 4$		$(-3, 4)$	UP	0	
$y = -(x+3)^2$		$(-3, 0)$	DOWN	1	$(-3, 0)$
$y = -5(x-4)^2 + 7$		$(4, 7)$	DOWN	2	$(2.8, 0)$ $(5.1, 0)$
$y = -\frac{1}{3}(x-2)^2 - 3$		$(2, -3)$	DOWN	0	

If the vertex is **above** the x-axis and the parabola **opens up**, there are 0 zeros.If the vertex is **above** the x-axis and the parabola **opens down**, there are 2 zeros.If the vertex is **on the x-axis**, there is 1 zero.If the vertex is **below** the x-axis and the parabola **opens up**, there are 2 zeros.If the vertex is **below** the x-axis and the parabola **opens down**, there are 0 zeros.

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5.1 Investigation: Solving Quadratic Equations

Part B: Equations in Factored Form

Use Desmos to complete the table.

Equation	Factors	Zeros	# zeros
$y = (x-1)(x+3)$	$(x-1) \text{ and } (x+3)$	$(1, 0)$ $(-3, 0)$	2
$y = 2(x-1)(x+3)$	$(x-1) \text{ and } (x+3)$	$(1, 0)$ $(-3, 0)$	2
$y = -2(2x-3)(2x-3)$	$(2x-3) \text{ and } (2x-3)$	$x = \frac{3}{2}$ $(1.5, 0)$	1
$y = -0.2(2x-3)(2x-3)$	$(2x-3) \text{ and } (2x-3)$	$(1.5, 0)$	1
$y = (2x+1)(2x+1)$	$(2x+1) \text{ and } (2x+1)$	$x = -\frac{1}{2}$ $(-0.5, 0)$	1
$y = -3(5x-2)^2$	$(5x-2) \text{ and } (5x-2)$ $x = \frac{2}{5}$	$x = \frac{2}{5}$ $(0.4, 0)$	1
$y = -3(5x-1)(x-4)$	$(5x-1) \text{ and } (x-4)$ $x = \frac{1}{5}$	$(0.2, 0)$ and $(4, 0)$	2
$y = \frac{-1}{3}(3x-4)(2x-3)$	$(3x-4) \text{ and } (2x-3)$ $x = \frac{4}{3}$ $x = \frac{3}{2}$	$(1.3, 0)$ and $(1.5, 0)$	2
$y = x(x-2)$	$(x) \text{ and } (x-2)$	$(0, 0)$ and $(2, 0)$	2
$y = 2x(x+3)$	$x \text{ and } (x+3)$	$(0, 0)$ and $(-3, 0)$	2
$y = \frac{-x}{5}(x+4) - \frac{1}{5}$	$(x)(x+4)$	$(0, 0)$ and $(-4, 0)$	2

A quadratic equation with 2 different factors will have 2 different zeros.An equation with 2 identical factors will have 1 zero.An equation with a factor of "x" will have a zero at (0, 0).The "a" value (vertical stretch) does not change the number or value of the zeros.

MPM2D

5.1 Investigation: Solving Quadratic Equations

Part C: Solving Equations that are equal to zero.The solutions to this equation: $0 = 4(x-3)^2 + 2$ Are zeros of this function: $y = 4(x-3)^2 + 2$

Use Desmos to determine the solutions to the following equations. If there are no zeros, write "no solution".

$0 = -2(x+5)^2 + 7$ $x = -6.9$ & $x = -3.1$	$4(x-1)^2 - 3 = 0$ $x = 0.1$ & $x = 1.9$	$0 = -2(x+4)^2 - 3$ NO SOLUTIONS
$3x^2 - 3x - 6 = 0$ $x = -1$ & $x = 2$	$0 = 4x^2 - 12x + 9$ $x = 1.5$	$5x^2 - 3x + 7 = 0$ NO SOLUTIONS

Part D: Solving Equations that are equal to a number other than zero.The solutions to this equation: $3 = 4(x-1)^2 - 2$

Are the points of intersection of these functions:
 $y = 4(x-1)^2 - 2$
 $y = 3$

Use Desmos to graph two functions to find the solution to each equation. If there is no solution, write "no solution".

$5 = (x+2)^2 - 1$ $x = -4.4$ & $x = 0.4$	$-2(x+1)^2 + 5 = 3$ $x = -2$ & $x = 0$	$-2 = 3x^2 - 2x - 4$ $x = -0.5$ & $x = 1.2$	$-2x^2 + 3x - 7 = 1$ NO SOLN
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For each equation in Part D....bring all the terms to one side of the equal sign and collect like terms. Find the zeros of your new equation using Desmos.

$5 = (x+2)^2 - 1$ $0 = (x+2)^2 - 6$ SAME!	$-2(x+1)^2 + 5 = 3$ $-2(x+1)^2 + 2 = 0$ SAME!	$-2 = 3x^2 - 2x - 4$ $0 = 3x^2 - 2x - 2$ SAME!	$-2x^2 + 3x - 7 = 1$ $-2x^2 + 3x - 8 = 0$ NO SOLN
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What do you notice?

Solving for intersection is the same as rearranging and find zeros!

MPM2D

5.1 Investigation: Solving Quadratic Equations

Part E: Solving Equations that are equal to another function.

The solutions to this equation:

$$2x^2 - 7x - 4 = x^2 - 6x + 3$$

Are the points of intersection of these functions:

$$y = 2x^2 - 7x - 4$$

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

Use Desmos to graph two functions to find the solution to each equation.

$2x^2 - 7x - 4 = x^2 - 6x + 3$ $x^2 - x - 7 = 0$ $x \approx -2.2 \quad \& \quad x \approx 3.2$	$4x^2 + 3x - 9 = 2x^2 - 2x + 5$ $2x^2 + 5x - 14 = 0$ $x \approx 4.2 \quad \& \quad x \approx 1.7$
$5x^2 - 5x + 7 = -4x^2 + x + 6$ $9x^2 - 6x + 1 = 0$ $x \approx 0.3$	$3x^2 + 4x - 2 = x^2 + 7x - 5$ $2x^2 - 3x + 3 = 0$ NO SOLN

For each equation in Part E....bring all the terms to one side of the equal sign and collect like terms. Find the zeros of your new equation using Desmos.

$2x^2 - 7x - 4 = x^2 - 6x + 3$	$4x^2 + 3x - 9 = 2x^2 - 2x + 5$
$5x^2 - 5x + 7 = -4x^2 + x + 6$	$3x^2 + 4x - 2 = x^2 + 7x - 5$

What do you notice?