

Activity 2.1 - Answer Key

Problem 1

True or False: If $a < 0$, then $f(x) = ax^2 + bx + c$ has a maximum.

True. Recall that a quadratic with $a < 0$ opens down,
and therefore its vertex is its maximum point.

Problem 2

Find the quadratic function with vertex $(-2, 3)$ and passes through the point $(1, 4)$.

Since we are given the vertex, we will use the standard form and use the given point to solve for the missing coefficient, a

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

$$f(x) = a(x - (-2))^2 + 3$$

$$4 = a(1 + 2)^2 + 3$$

$$4 = 9a + 3$$

$$1 = 9a$$

$$a = \frac{1}{9}$$

$$f(x) = \frac{1}{9}(x + 2)^2 + 3$$

Problem 3

Write in general form: $f(x) = 2(x - 3)^2 - 19$

$$f(x) = 2(x^2 - 6x + 9) - 19$$

$$f(x) = 2x^2 - 12x + 18 - 19$$

$$f(x) = 2x^2 - 12x - 1$$

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Problem 4

What is the vertex of $f(x) = x^2 - 10x + 1$

$$\begin{aligned}\text{The vertex is given by } & \left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right) \\ & = \left(-\frac{-10}{2(1)}, f\left(-\frac{-10}{2(1)}\right)\right) \\ & = (5, f(5))\end{aligned}$$

$$\text{Calculating } f(5) = (5)^2 - 10(5) + 1 = -24$$

So, the final answer is: $(5, -24)$

Problem 5

Write in standard form: $f(x) = -3x^2 - 6x + 4$

$$f(x) = -3(x^2 + 2x) + 4$$

$$f(x) = -3(x^2 + 2x + 1) + 4 + 3$$

$$f(x) = -3(x + 1)^2 + 7$$

Problem 6

What is the range of $f(x) = -3(x + 1)^2 + 2$

To find the range, you need to determine the vertex and whether the quadratic opens up or down. See that $a = -3$ and the vertex is $(-1, 2)$, so graph opens down and has the vertex as its max.

Therefore, the range of the function is $(-\infty, 2]$

Problem 7

Describe the transformations on $g(x) = -(x - 2)^2 + 4$ from the parent function $f(x) = x^2$

Right 2, reflection over the x-axis, and up 4

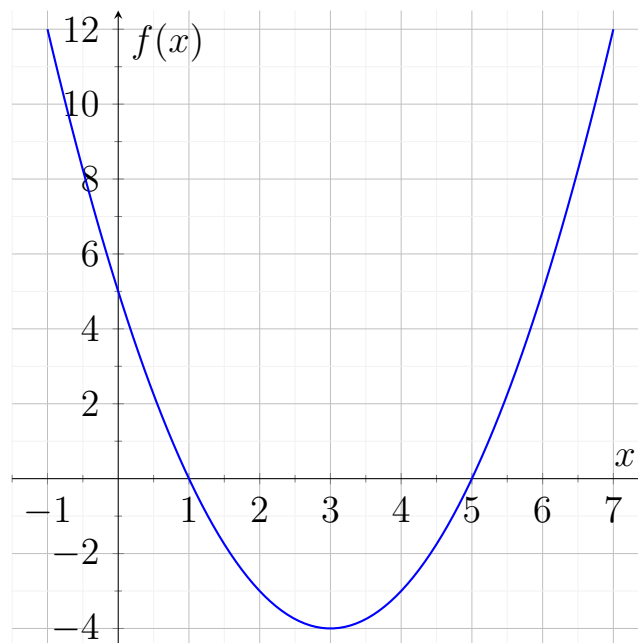
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Graphing problems:

Problem 8

Graph: $f(x) = -4 + (x - 3)^2$

1. $a = 1 > 0$, upward
2. Vertex: $(3, -4)$
3. x-intercepts: $0 = -4 + (x - 3)^2$
 $\pm 2 = x - 3$
 $x = 1, 5$
4. y-intercept: $y = -4 + (0 - 3)^2$
 $y = -4 + 9$
 $y = 5$



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Problem 9

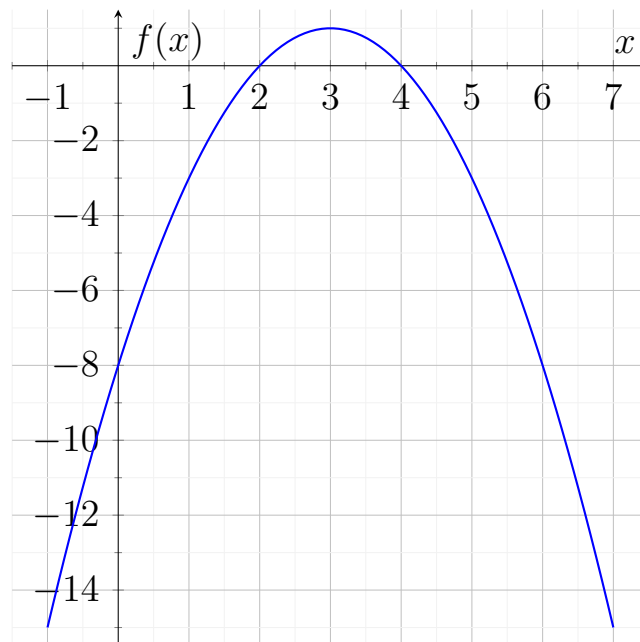
Graph: $f(x) = -x^2 + 6x - 8$

1. $a = -1 < 0$, downward

2. Vertex: $(\frac{-6}{-2}, f(\frac{-6}{-2}))$
 $= (3, 1)$

3. x-intercepts: $f(x) = -(x^2 - 6x + 8)$
 $= -(x - 4)(x - 2)$
 $x = 2, 4$

4. y-intercept: $y = -0^2 + 6 * 0 - 8$
 $y = -8$



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Problem 10

Graph: $f(x) = x^2 - 2x + 2$

Will convert to standard form: $f(x) = (x^2 - 2x + 1) + (2 - 1)$

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

1. $a = 1 > 0$, upward

2. Vertex: $(1, 1)$

3. x-intercepts: $0 = (x - 1)^2 + 1$

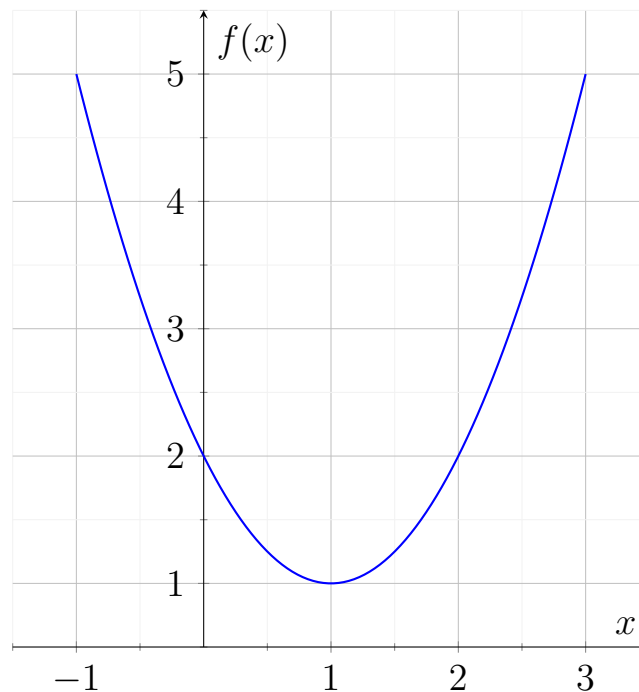
$$\pm i = x - 1$$

$$x = 1 \pm i$$

No real zeros

4. y-intercept: $y = 0^2 - 2 * 0 + 2$

$$y = 2$$



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Secret Phrase

What was the secret word you found?

WHISTLE