Quadratic Functions

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Per 7th
Math 2

Where are quadratic functions seen or used?

Quadratic Functions are seen in

1. Sydney Harbour Bridge
2. Eiffel Tower
3. Sydney Opera House
4. Skyscraper in Dubai
5. Colorado Street Bridge

Are Quadratic functions use in professions?

Military and Law Enforcement -- use it to describe the motion of objects that fly through the air. The military uses quadratic equations to determine where shells will land, when using artillery or tanks.

Automotive Engineers -- use quadratic equations to design brake systems in our automobiles.

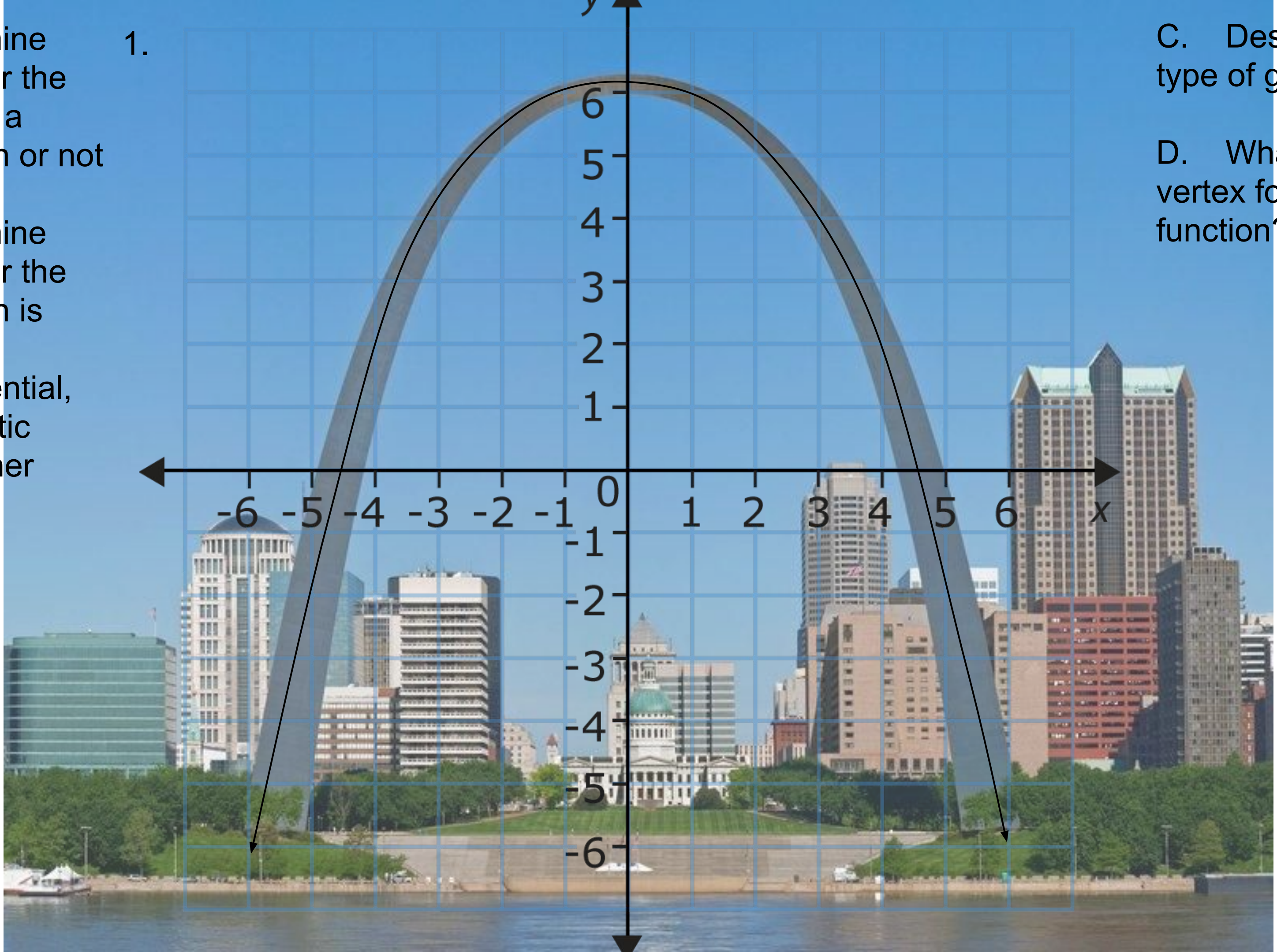
Astronomers -- use quadratic equations to describe the orbits of planets, solar systems and galaxies.

Agriculture -- quadratic equations are used to find out the optimal organization of boundaries to construct the biggest fields.

A. Determine whether the Arch is a function or not

B. Determine whether the function is linear, exponential, quadratic or neither

1.



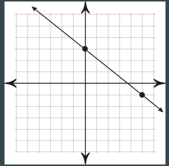
C. Describe the type of growth

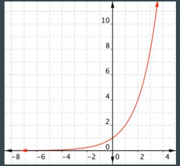
D. What is the vertex form of this function?

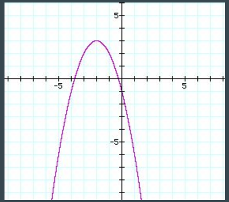
Gateway Arch in St. Louis

A. To determine if the arch is a function, just use the vertical line test. !YES!

B. To determine whether its linear, exponential, or quadratic you use the common knowledge of how each function looks like.

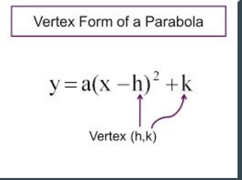






!Quadratic!

C. It has two types of growth, 1st increasing starting at (-∞,0) than decreasing at (0,∞).



D. To get the vertex form you can 1st find the slope which is 1⇩ and 2⇨ = -½, 2nd you find the vertex and you can tell it's (0,6). So just plug in these numbers into the vertex form giving you

$$y = -\frac{1}{2}(x-0)^2 + 6$$

2. Multiply this quadratic equation?

$(x + 2)(x + 2)$

Step 1: Factor it out.

$(x + 2)\ (x + 2)$

x^2 + 2x + 2x + 4

Step 2: Simplify it.

(Combine like Terms)

x^2 + 2x + 2x + 4

x^2 + 4x +4

Step 3: Final Answer

x^2 + 4x +4

3. Find the height of the Colorado Street Bridge?

Step 1: What are the x-intercepts?

They are (-4,0) & (4,0)

Step 2: Plug the x-intercepts into factored form.

$$f(x)= - (x - 4) (x + 4)$$

Step 3: Factor it out.

$$f(x)= - (x - 4) (x + 4)$$

$$f(x)= - (x^2 - 4x + 4x + 16)$$

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3. Find the height of the Colorado Street Bridge?

Step 4: Simplify (combine like terms)

f(x)= - (x^2 - 4x + 4x + 16)

They cancel out ⇨ - 4x + 4x

f(x)= - (x^2 + 16)

Step 5: What is the vertex?

f(x)= - (x^2 + 16)

The vertex is (0, 16)

Step 6 : What is the height of the bridge(parabola)?

(0, 16)

Height = 16 = 200

4. If the table is quadratic, develop a quadratic function for the table?

x	y
0	1
1	6
2	17
3	34

5
11
17

6
6

Step 1: Does the table represent a quadratic function? To figure that out you just see if the 2nd difference is constant (not 1st)

Step 2: Is the 1st difference constant? No

Step 3: Is the 2nd difference constant? Yes

Step 4: So now you can make a quadratic function for the table. 1st you want to find “a” or constant rate, in this case it's 6.

Step 5: then you divide “6” by 2 which is 3.A = 3

$y = ax^2 + bx + c$

$y = \underline{3}x^2 + \underline{\quad}x + \underline{\quad\quad}$

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$y = ax^2 + bx + c$

$y = \underline{3}x^2 + \underline{2}x + \underline{1}$

x	3x^2 +1		y
0	1		1
1	4	+2	6
2	13	+4	17
3	28	+6	34

5 11 17

6 6

Step 6: Now find "c" which is easy to do, all you do is look at what y = to 0. In this case it is 1.

Step 7: To find "b", I used of what the equation has so far which is 3x^2 + 1. Now plug in x into that formula.

Step 8: Now what do you have to add to "x" in order to get y? Now find out the GCF?

Step 9: It is 2. So b = 2x.

Step 10: Now you're done. The quadratic function is

$y = ax^2 + bx + c$

$y = \underline{3}x^2 + \underline{2}x + \underline{1}$

5. Complete the square

Step 1: $x^2 + 6x - 7 = 0$
$+7 \quad +7$

Step 2: $x^2 + 6x + \underline{9} = 7 + \underline{9}$

$\left(\frac{\boxed{b}}{\boxed{2}}\right)^2$

$\left(\frac{\boxed{6}}{\boxed{2}}\right)^2 = (3)^2$
$= 9$

Step 3: $x^2 + 6x + 9 = 16$

Step 4: $\sqrt{(x + 3)^2} = \mp\sqrt{16}$

Step 5: $x + 3 = \mp\sqrt{16}$

Step 6: $x + 3 = \mp 4$

There are two outcomes

Step 7: $x + 3 = 4$

$x = 1$

Step 7: $x + 3 = -4$

$x = -7$

6. Solve this problem using the quadratic formula

Step 1: $x^2 - 3x - 4 = 0$

Step 2: A = 1, B = -3, C = -4

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Step 4:

$$x = \frac{3 \pm \sqrt{9 - 4(1)(-4)}}{2\,(1)}$$

Step 5:

$$\frac{3 \pm \sqrt{9 + 16}}{2}$$

Step 6:

$$x = \frac{3 \pm \sqrt{25}}{2}$$

Step 7: $\frac{3 \mp 5}{2}$

Step 8: {4, -1}

Curly braces b/c they are both x-intercepts