

Quadratic Functions

Key:

Any problem that involves units², cost/m², area of land, falling objects, rockets....

Looks like a U.

Rule: $f(x) = ax^2$ Vertex (0,0)

Graph the following parabolas after filling in the table of values for each.

1) $f(x) = x^2$ $\textcircled{x} = -3$
 $f(x) = (-3)^2 = 9 \rightarrow (-3)(-3) = 9$

x	-3	-2	-1	0	1	2	3
y	9	4	1	0	1	4	9

2) $f(x) = 2x^2$

x	-3	-2	-1	0	1	2	3
y	18	8	2	0	2	8	18

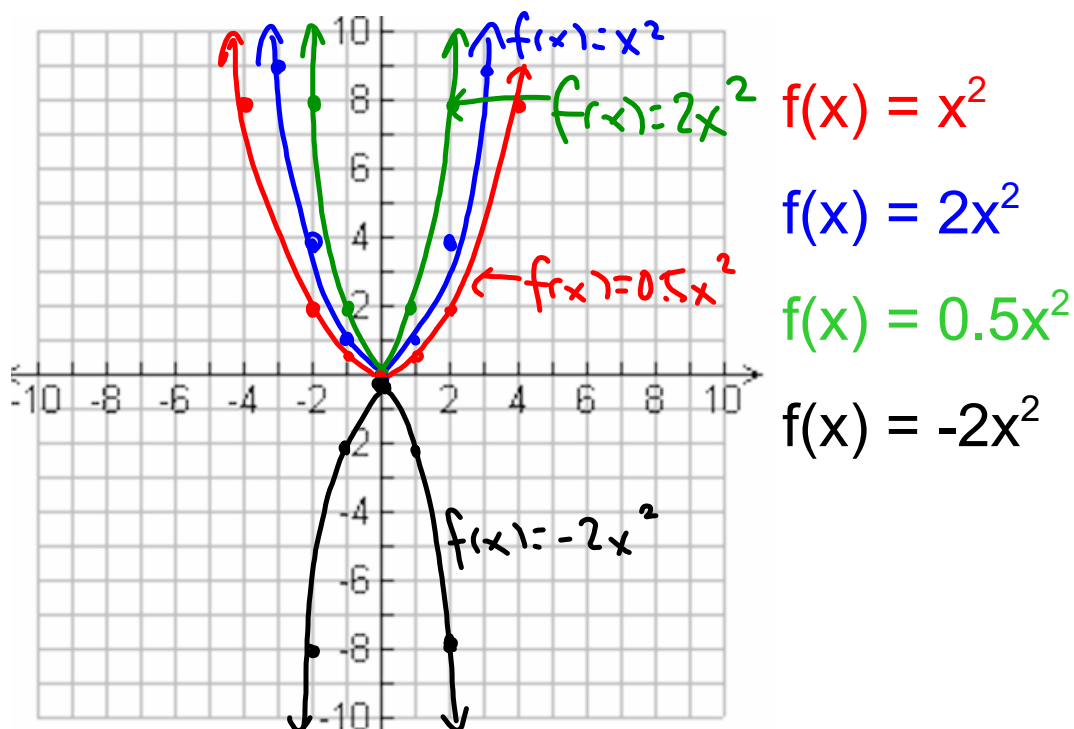
$x = -3$ $f(x) = 2(-3)^2 = 18$

3) $f(x) = 0.5x^2$ $x = -4$ $f(x) = 0.5(-4)^2$

x	-4	-2	-1	0	1	2	4
y	8	2	0.5	0	0.5	2	8

4) $f(x) = -2x^2$ $x = -3 \Rightarrow f(x) = -2(-3)^2 =$

x	-3	-2	-1	0	1	2	3
y	-18	-8	-2	0	-2	-8	-18



The role of 'a':

- If **a is positive**, the parabola opens up
- If **a is negative**, the parabola opens down
- If **a > 1**, and increases, the parabola gets skinnier
- If **$0 < a < 1$** , means, if a is a fraction or decimal between 0 and 1, the parabola is fatter.

Note: Quadratic functions are also called Parabolas and Second Degree Functions.

Finding the Rule of a Quadratic Function

Find the equation of the parabola with a vertex of (0,0) and passing through the given point.

a) P(4,32)

$$y = ax^2$$

$$32 = a(4)^2$$

$$32 = \frac{a(16)}{16}$$

$$a = 2$$

$$f(x) = 2x^2$$

b) P(2,-3)

$$f(x) = ax^2$$

$$-3 = a(2)^2$$

$$-3 = \frac{a(4)}{4}$$

$$f(x) = -\frac{3}{4}x^2$$

or

$$f(x) = -0.75x^2$$

c) P(2,4)

$$f(x) = ax^2$$

$$4 = a(2)^2$$

$$4 = \frac{a(4)}{4}$$

$$a = 1$$

$$f(x) = x^2$$

Word problems with Parabolas

1) The cost of a square field being sold is $C=20x^2$, where x is the side length in meters and C is the cost (\$).

What are the dimensions of a field that costs \$32,000? $x=?$

$$C = 20x^2$$

$$\frac{32000}{20} = \frac{20x^2}{20}$$

$$1600 = x^2 \quad (\sqrt{\quad})$$

$$\sqrt{1600} = x$$

$$40 = x$$

\therefore The lot is 40 x 40 m.

2) A real estate agent is selling square shaped lots. A lot with side lengths of 25 m is sold for \$12 500.

a) What is the rule of the function?

$$f(x) = ax^2$$

$$12500 = a(25)^2$$

$$\frac{12500}{625} = \frac{a(625)}{625}$$

$$a = 20$$

$$\therefore f(x) = 20x^2$$

b) What is the cost of a lot with sides of 30 m?

$$f(x) = 20(30)^2$$

$$= \$18000$$