

Learning Goal - I will be able to determine the equation of the parabola in vertex form.

Minds on What's the equation?

Action! Finding equations in vertex form

Consolidation Practice!

Page 280 #2, 3bdf, 5adef, 6d, 7a, 8, 11, 13, 15

Minds on

Determine the equation for the relation.

Time (s)	Height (m)
5	0
6	7
9	15
11	20
13	19
15	14
19	0

Zeros 5 & 19

$$y = a(x-r)(x-s)$$

$$y = a(x-5)(x-19)$$

$$7 = a(6-5)(6-19)$$

$$7 = a(1)(-13)$$

$$7 = a(-13)$$

$$\frac{7}{-13} = a$$

$$y = -\frac{7}{13}(x-5)(x-19)$$

5.4 – Quadratic Models Using Vertex Form

To determine the equation of a parabola in vertex form you must have the coordinates of the vertex (h, k) and one other point on the parabola.

- 1) Use the vertex for h and k in the equation and the values of x and y from the other point.
- 2) Rearrange the equation to solve for the missing a value (the step-pattern).
- 3) Write the equation with the vertex and the a value you calculated in step (2).

Example 1: Determine the equation of a quadratic relation with vertex $(1.85, 300)$ that goes through the point $(0.85, 150)$.

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

$$y = a(x - 1.85)^2 + 300$$

$$150 = a(0.85 - 1.85)^2 + 300$$

$$150 - 300 = a(-1)^2$$

$$-150 = a(1)$$

$$-150 = a$$

$$\therefore \text{the eq'n is } y = -150(x - 1.85)^2 + 300$$

Example 2: The amount of gasoline a car consumes depends on its speed.

x	Speed (km/h)	10	20	30	40	50	60	70	80	90	100	110
y	Gas Consumed (L/100 km)	9.2	8.1	7.4	6.4	6.1	5.9	5.8	6.0	6.3	7.5	8.4

a) Determine an equation that models the relationship between speed and fuel consumption.

Vertex (70, 5.8)

$$y = a(x - 70)^2 + 5.8$$

pt. (80, 6)

$$6 = a(80 - 70)^2 + 5.8$$

$$6 - 5.8 = a(10)^2$$

b) Use Quadratic Regression to check your answer.

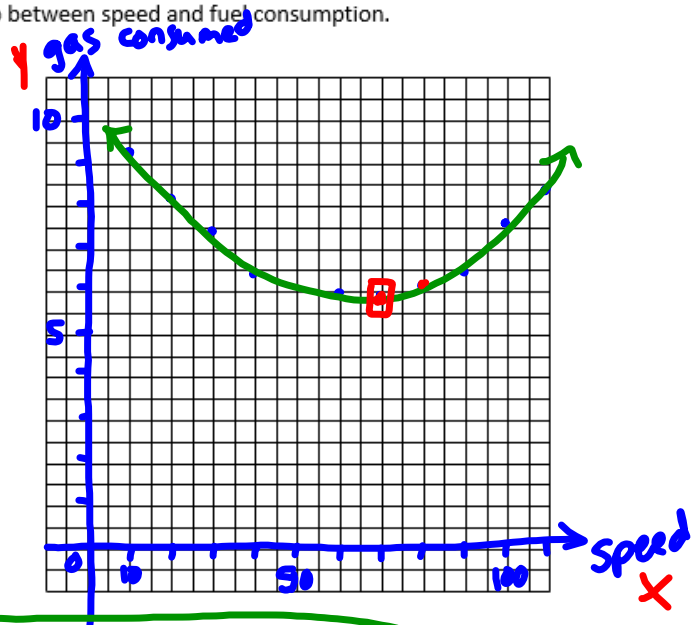
$$0.2 = a(100)$$

$$\frac{0.2}{100} = a$$

$$0.002 = a$$

$$\therefore \text{the eq'n is } y = 0.002(x - 70)^2 + 5.8$$

$$y = 0.0012x^2 - 0.1544x + 10.7315$$



Example 3: Write the equation of the parabola, in vertex form, represented by the following data.

x	2	3	4	5	6
y	-33	-13	-1	3	-1

vertex

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

$$y = a(x-5)^2 + 3$$

sub. in pt. (4, -1)

$$-1 = a(4-5)^2 + 3$$

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

$$-4 = a(1)$$

$$-4 = a$$

$$\therefore \text{the eqn is } y = -4(x-5)^2 + 3$$

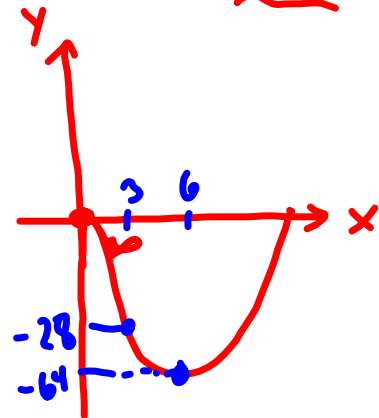
Example 4: Konner drops a fish into the water from a sailing boat. The fish drops below the surface of the water and reaches a depth of -28 m when it is 3m from the edge of the boat BEFORE reaching its maximum depth of -64 m, 6 m from the edge of the boat.

Let y rep. the depth

Let x rep. the distance from the boat.

vertex $(6, -64)$

pt. $(3, -28)$



$$y = a(x-6)^2 - 64$$

$$-28 = a(3-6)^2 - 64$$

$$-28 + 64 = a(-3)^2$$

$$36 = a(9)$$

$$\frac{36}{9} = a$$

$$4 = a$$

∴ the eq'n is

$$y = 4(x-6)^2 - 64$$

Consolidation

Example 5: A toy rocket that is sitting on a tower is launched vertically upward. It reaches a maximum height of 61.25 feet, 2.5 seconds after launch. One second after launch, the rocket was 50 feet in the air.

Page 280 #2, 3bdf, 5adef, 6d, 7a, 8, 11, 13, 15