

## Quadratic Functions: Word Problems

**Type 1:** Solve for  $x$  when  $y = 0$  (Solve by factoring).

- e.g. 1 Jose is practicing his baseball hitting. He hits the ball whose trajectory is defined by the equation:  $y = \frac{-7}{48}(x - 12)^2 + 21$ , where  $y$  represents the height of the ball and  $x$ , the distance it travels. The variables  $x$  and  $y$  are expressed in metres. How far does the ball travel? Clearly show all your work.

Now you try:

1. While golfing, Alain hits the ball whose trajectory is defined by the equation:  $y = \frac{-5}{81}(x - 18)^2 + 20$ , where  $y$  represents the height of the ball and  $x$ , the distance it travels. The variables  $x$  and  $y$  are expressed in metres. How far does the ball travel? Clearly show all your work.

2. Todd kicks a soccer ball into the air. The ball's trajectory is defined by the equation:  $y = \frac{-2}{49}(x - 14)^2 + 8$ , where  $y$  represents the height of the ball and  $x$ , the distance it travels. The variables  $x$  and  $y$  are expressed in metres. How far does the ball travel? Clearly show all your work.

3. Vanessa throws a javelin, whose trajectory is defined by the equation:  $y = \frac{-3}{13}(x - 13)^2 + 39$ , where  $y$  represents the height of the javelin and  $x$ , the distance it travels. The variables  $x$  and  $y$  are expressed in metres. How far does the javelin travel? Clearly show all your work.

4. While golfing at Mont Tremblant, Chris hits a ball whose trajectory is defined by the equation:  $y = \frac{-5}{32}(x - 16)^2 + 40$ , where  $y$  represents the height of the ball and  $x$ , the distance it travels. The variables  $x$  and  $y$  are expressed in metres. How far does the ball travel? Clearly show all your work.

5. Jennifer hits a softball whose trajectory is defined by the equation:  
 $y = \frac{-4}{17}(x - 17)^2 + 68$ , where  $y$  represents the height of the ball and  $x$ , the distance it travels. The variables  $x$  and  $y$  are expressed in metres. How far does the ball travel? Clearly show all your work.

**Type 2: Calculating the abscissa of the vertex:**  $x = \frac{-b}{2a}$

e.g. 1 After  $x$  seconds, the height in metres of a ball thrown up into the air is  $y = 30x - 5x^2$ . Calculate the time required for the ball to reach its maximum height.

Now you try:

1. The height in metres reached by an object  $x$  seconds after being thrown into the air is represented by  $y = -5x^2 + 20x + 30$ . Calculate the time required for this object to reach its maximum height.

2. Alka, the CFO of RGA Insurance, tracked the price of her company's shares over a three-week period. She discovered that the share price fluctuated according to the equation  $y = \frac{x^2}{6} - 3x + 11.5$ , where  $x$  represents a specific day during the observation period and  $y$ , the share price in \$. On which day did the share price reach its lowest point? Clearly show all your work.

3. An object is thrown from the top of a building 15m high. The height in metres reached by the object with respect to the time in seconds is represented by the following equation:

$$y = -\frac{18}{5}x^2 + \frac{144}{5}x + 15$$

Determine how long it will take the object to reach its maximum height.

4. During an economical slump, the equation  $y = \frac{x^2}{4} - 4x + 14.2$  represents the profit earned by a company over  $x$  number of days. On which day did the profit reach its lowest point? Clearly show all your work.

5. An object is thrown from the top of a building 14m high. The height in metres reached by the object with respect to the time in seconds is represented by the following equation:

$$y = -\frac{25}{7}x^2 + \frac{250}{7}x + 14$$

Determine how long it will take the object to reach its maximum height.



**Type 3: Determining the perimeter of a rhombus**

e.g. 1 A rhombus has an area of  $70\text{cm}^2$ . Given that the long diagonal measures 4cm more than the short diagonal, determine the perimeter of the rhombus. Clearly show all your work.

Now you try:

1. A rhombus has an area of  $135\text{cm}^2$ . Given that the long diagonal measures 3 cm more than the short diagonal, determine the perimeter of the rhombus. Clearly show all your work.



2. A rhombus has an area of  $104\text{cm}^2$ . Given that the long diagonal measures 3 cm more than the short diagonal, determine the perimeter of the rhombus. Clearly show all your work.

3. A rhombus has an area of  $82.5 \text{ cm}^2$ . Given that the long diagonal measures 4 cm more than the short diagonal, determine the perimeter of the rhombus. Clearly show all your work.

4. A rhombus has an area of  $96\text{cm}^2$ . Given that the long diagonal measures 4 cm more than the short diagonal, determine the perimeter of the rhombus. Clearly show all your work.

5. A rhombus has an area of  $110.5 \text{ cm}^2$ . Given that the long diagonal measures 4 cm more than the short diagonal, determine the perimeter of the rhombus. Clearly show all your work.

**Type 4: time =  $\frac{\text{distance}}{\text{velocity}}$**

e.g. #1 A school bus must travel 550 km to take some students to a sports tournament. If the coach, driving his car, takes the same route, but travels 40 km/h faster than the school bus, the travel time could be reduced by 2.3 hours. What is the speed of the school bus? Round off your answer to the nearest unit. Clearly show all your work.

Now you try:

1. A bus must travel a distance of 510 km. If a train were to take the same route, but travel 45 km/h faster than the bus, the travel time could be reduced by 1.7 hours. What is the speed of the bus? Round off your answer to the nearest unit.



2. Andrew must drive his Excel a distance of 620 km. If Cole, in his Mustang, takes the same route, but travels 27 km/h faster than Andrew, the travel time could be reduced by 1.4 hours. What is Andrew's speed in the Excel? Round off your answer to the nearest unit.

3. A freight train must travel a distance of 620 km. If a truck were to take the same Route, but travel 50 km/h faster than the freight train, the travel time could be reduced by 7.2 hours. What is the speed of the freight train? Round off your answer to the nearest unit.

4. Trevor bikes an 80-km scenic route along the ocean. Sean drives his car through the same route, and saves 1.7 hours, compared to Trevor's biking time. If Sean's speed is 50 km/h faster than Trevor's, then what is Trevor's speed?

5. A car and a bus both travel through the same 714-km road trip. The car travels 20 km/h faster than the bus, and so the car does the trip in 1.4 hours less than the bus. What is the speed of the bus?

**Type 5: time =  $\frac{\text{volume}}{\text{rate of flow}}$**

e.g.1 In a factory, 75-litre containers are placed on a conveyor belt and filled with liquid as they pass under a tap one by one. If the flow from the tap was increased by 44 litres per minute, it would take 45 fewer seconds to fill each container. What is the flow from the tap to the nearest litre? Clearly show all your work.

Now you try:

1. In a factory, 120-litre containers are placed on a conveyor belt and filled with liquid as they pass under a tap one by one. If the flow from the tap was increased by 17 litres per minute, it would take 30 fewer seconds to fill each container. What is the flow from the tap to the nearest litre? Clearly show all your work.



2. In a factory, 100-litre containers are placed on a conveyor belt and filled with liquid as they pass under a tap one by one. If the flow from the tap was increased by 8 litres per minute, it would take 15 fewer seconds to fill each container. What is the flow from the tap to the nearest litre? Clearly show all your work.

3. In a factory, 80-litre containers are placed on a conveyor belt and filled with liquid as they pass under a tap one by one. If the flow from the tap was increased by 94 litres per minute, it would take 90 fewer seconds to fill each container. What is the flow from the tap to the nearest litre? Clearly show all your work.

4. In a factory, 140-litre containers are placed on a conveyor belt and filled with liquid as they pass under a tap one by one. If the flow from the tap was increased by 27 litres per minute, it would take 75 fewer seconds to fill each container. What is the flow from the tap to the nearest litre? Clearly show all your work.

5. In a factory, 110-litre containers are placed on a conveyor belt and filled with liquid as they pass under a tap one by one. If the flow from the tap was increased by 45 litres per minute, it would take 45 fewer seconds to fill each container. What is the flow from the tap to the nearest litre? Clearly show all your work.

**Type 6: Writing Second-Degree Equations for Word Problems (no solving!)**

e.g.1 The area of a rectangle is  $520 \text{ cm}^2$ . Given that the length of the rectangle is 5 cm longer than the width, determine the second-degree equation of the form  $ax^2 + bx + c = 0$ .

You try:

1. The area of a rectangle is  $315 \text{ cm}^2$ . Given that the length of the rectangle is 11 cm longer than the width, determine the second-degree equation of the form  $ax^2 + bx + c = 0$ .

2. The area of a rectangle is  $283 \text{ cm}^2$ . Given that the length of the rectangle is 7 cm longer than the width, determine the second-degree equation of the form  $ax^2 + bx + c = 0$ .

3. Mary measured the front of her refrigerator. She found that it measures  $13\,860\text{ cm}^2$ . Given that the refrigerator is  $81\text{ cm}$  longer than it is wide, determine the second-degree equation of the form  $ax^2 + bx + c = 0$  that describes this situation.
4. Sam measured the area of the top of his laptop. He found that it measures  $775\text{ cm}^2$ . Given that the laptop is  $6\text{ cm}$  longer than it is wide, determine the second-degree equation of the form  $ax^2 + bx + c = 0$  that describes this situation.
5. Jacob measured the area of the front of his television. He found that it measures  $4636\text{ cm}^2$ . Given that the television is  $15\text{ cm}$  longer than it is wide, determine the second-degree equation of the form  $ax^2 + bx + c = 0$  that describes this situation.





3. The square of a number increased by four times that number is equal to 165. Determine the second-degree equation of the form  $ax^2 + bx + c = 0$  that describes this situation.
4. The square of a number increased by five times that number is equal to 104. Determine the second-degree equation of the form  $ax^2 + bx + c = 0$  that describes this situation.
5. The square of a number increased by twice that number is equal to 323. Determine the second-degree equation of the form  $ax^2 + bx + c = 0$  that describes this situation.