MPM2D1

Quadratic Functions - Additional Review

Applications

4. Write an equation for the parabola created when each pair of transformations is applied to the graph of $y = x^2$.

a) a reflection in the x-axis, followed by a vertical translation of -3

b) a vertical translation of 2, followed by a vertical stretch of scale factor 3

5. The graph of $y = 4x^2 + k$ passes through the point $(-1, -1)$. Find k.

6. The graph of $y = ax^2 + k$ passes through the points $(2, 3)$ and $(-4, -9)$. Find a and k.

Applications

4. Write an equation for each parabola.

a) vertex $(3, -1)$; $a = -2$

b) vertex $(2, 5)$; congruent to $y = \frac{1}{2}x^2$

c) vertex $(-4, -1)$; y-intercept -9

d) vertex $(-5, 3)$; through $(-7, 15)$

5. The vertex of a parabola is $(-3, 7)$. The y-intercept is 0. What are the x-intercepts?

Problem Solving

5. Determine the maximum area of a triangle, in square centimetres, if the sum of its base and its height is 12 cm.

6. A ball is thrown upward with an initial velocity of 18 m/s. Its height, h metres after t seconds, is given by the equation

$$h = -5t^2 + 18t + 1.8$$

where 1.8 represents the height at which the ball is released by the thrower.

a) What is the maximum height the ball will reach?

b) How much time elapses before the ball reaches the maximum height?

c) How long is the ball in the air, to the nearest tenth of a second?

10. **Communication:** What transformations must be applied to the graph (to produce the graph of $y = 2x^2 - 12x + 7$? Justify your reasoning.

11. A model rocket is launched straight upward with an initial velocity of 200 m/s. The height of the rocket h, in metres, can be modelled by $h = -5t^2 + 200t$, where t is the elapsed time in seconds. What is the maximum height the rocket reaches?

12. **Knowledge and Understanding:** The cost C, in dollars, of operating a concrete-cutting machine is modelled by $C = 2.2n^2 - 66n + 655$, where n is the number of minutes the machine is run. How long must the machine run for the operating cost to be at a minimum? What is the minimum cost?

13. Find the dimensions of a rectangle that has a perimeter of 40 cm and the largest possible area.

14. A police officer is investigating a crime. He wants to seal the area around the scene with a roll of yellow police tape that is 300 m long. What are the dimensions of the maximum rectangular area? What is the maximum area?

15. Randy is building a fence at the side of his warehouse. He has 120 m of fencing and plans to use the side of the warehouse as one side of the rectangular fenced area. What are the dimensions of the maximum area Randy can enclose?

16. A rectangular field will be fenced on all four sides. There will also be a line of fence across the field, parallel to the shorter side. If 900 m of fencing are available, what dimensions of the field will produce the maximum area?

17. (a) The sum of two numbers is 26. The sum of their squares is a minimum. Find the numbers.

(b) Verify your results using technology. Use technology to find the numbers if the sum of their squares is 442.

18. The city transit system carries 24 800 bus riders per day for a fare of \$1.85. The city hopes to reduce car pollution by getting more people to ride the bus, while maximizing the transit system's revenue at the same time. A survey indicates that the number of riders will increase by 800 for every \$0.05 decrease in the fare. What fare will produce the greatest revenue?