The Dragon Academy
G11 Functions and Applications
Term 3
Assignment 2
Due date: Fri Feb. 22 2019

February 15, 2019

In Summary

Key Idea

- All quadratic equations can be expressed in the form $ax^2 + bx + c = 0$ using algebraic techniques. They can be solved by graphing the corresponding function $f(x) = ax^2 + bx + c$. The zeros, or x-intercepts, of the function are the solutions, or roots, of the equation.

Need to Know

- A quadratic equation is any equation that contains a polynomial whose highest degree is 2. For example, $x^2 + 8x + 15 = 0$.
- An alternative to solving $ax^2 + bx + c = d$ is to graph both $y = ax^2 + bx + c$ and $y = d$. The solutions will be those points where the two functions intersect.
- You should substitute the solutions into the original equation to verify the result.

CHECK *Your Understanding*

1. Graph each function by hand. Then use the graph to solve the corresponding quadratic equation.

a) $g(x) = -x^2 + 5x + 14$ and $-x^2 + 5x + 14 = 0$

b) $f(x) = x^2 + 8x + 15$ and $x^2 + 8x + 15 = 0$

2. Graph each function using a graphing calculator. Then use the graph to solve the corresponding quadratic equation.

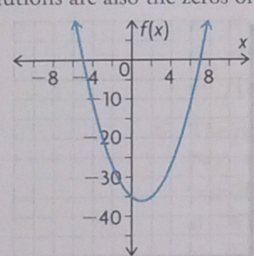
a) $h(x) = x^2 - x - 20$ and $x^2 - x - 20 = 0$

b) $f(x) = x^2 - 5x - 9$ and $x^2 - 5x - 9 = 0$

PRACTISING

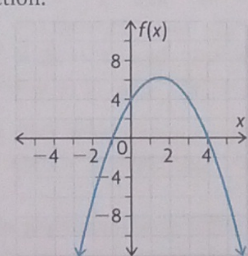
3. For each function, write the corresponding quadratic equation whose solutions are also the zeros of the function.

a)



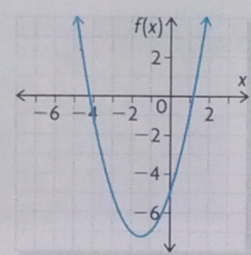
$y = x^2 - 2x - 35$

b)



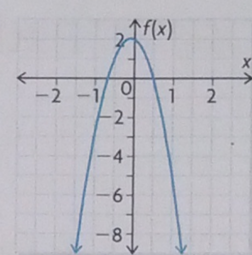
$y = -x^2 + 3x + 4$

c)



$y = x^2 + 3x - 5$

d)



$y = -6x^2 - x + 2$

4. Graph the corresponding function to determine the roots of each equation. Verify your solutions.

a) $x^2 - 8x = -16$

b) $2x^2 + 3x - 20 = 0$

c) $-5x^2 + 15x = 10$

d) $x^2 + 4x = 8$

e) $x^2 + 5 = 0$

f) $4x^2 - 64 = 0$

5. K Graph each function. Then use the graph to solve the quadratic equation.

a) $p(x) = 3x^2 + 5x - 2$ and $3x^2 + 5x - 2 = 0$

b) $f(x) = 2x^2 - 11x - 21$ and $2x^2 - 11x - 21 = 0$

c) $p(x) = 8x^2 + 2x - 3$ and $8x^2 + 2x - 3 = 0$

d) $f(x) = 3x^2 + x + 1$ and $3x^2 + x + 1 = 0$

6. The population, $P(t)$, of an Ontario city is modelled by the function $P(t) = 14t^2 + 650t + 32\ 000$. *Note:* $t = 0$ corresponds to the year 2000.

a) What will the population be in 2035?

b) When will the population reach 50 000?

c) When was the population 25 000?

7. The function $h(t) = 2.3 + 50t - 1.86t^2$ models the height of an arrow shot from a bow on Mars, where $h(t)$ is the height in metres and t is time in seconds. How long does the arrow stay in flight?

8. The height of an arrow shot by an archer is given by the function $h(t) = -5t^2 + 18t - 0.25$, where $h(t)$ is the height in metres and t is time in seconds. The centre of the target is in the path of the arrow and is 1 m above the ground. When will the arrow hit the centre of the target?

9. The student council is selling cases of gift cards as a fundraiser. The revenue, $R(x)$, in dollars, can be modelled by the function $R(x) = -25x^2 + 100x + 1500$, where x is the number of cases of gift cards sold. How many cases must the students sell to maximize their revenue?

10. The Wheely Fast Co. makes custom skateboards for professional riders. The company models its profit with the function $P(b) = -2b^2 + 14b - 20$, where b is the number of skateboards produced, in thousands, and $P(b)$ is the company's profit, in hundreds of thousands of dollars.

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a) How many skateboards must be produced for the company to break even?

b) How many skateboards does Wheely Fast Co. need to produce to maximize profit?

Communication ***Tip***

A company's break-even point is the point at which the company shows neither a profit nor a loss. This occurs when the profit is zero.

11. A ball is tossed upward from a cliff that is 40 m above water. The height of the ball above the water is modelled by $h(t) = -5t^2 + 10t + 40$, where $h(t)$ is the height in metres and t is the time in seconds. Use a graph to answer the following questions.

a) What is the maximum height reached by the ball?

b) When will the ball hit the water?

12. The cost, $C(n)$, in dollars, of operating a concrete-cutting machine is modelled by $C(n) = 2.2n^2 - 66n + 655$, where n is the number of minutes the machine is in use.

a) How long must the machine be in use for the operating cost to be a minimum?

b) What is the minimum cost?

13. a) For each condition, determine an equation in standard form of a quadratic function that

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i) has two zeros

ii) has one zero

iii) has no zeros

b) What is the maximum number of zeros that a quadratic function can have? Explain.

14. a) What quadratic function could be used to determine the solution of the quadratic equation $3x^2 - 2x + 5 = 4$?

C

b) Explain how you could use the function in part (a) to determine the solutions of the equation.