Name _____ Date _____ Class _____

TEKS 2A.5.E

LESSON 5-4

Problem Solving

Completing the Square

Sean and Mason run out of gas while fishing from their boat in the bay. They set off an emergency flare with an initial vertical velocity of 30 meters per second. The height of the flare in meters can be modeled by $h(t) = -5t^2 + 30t$, where t represents the number of seconds after launch.

1. Sean thinks the flare should reach at least 15 meters to be seen from the shore. They want to know how long the flare will take to reach this height.

a. Write an equation to determine how long it will take the flare to reach 15 meters. _____

b. Simplify the function so you can complete the square. _____

c. Solve the equation by completing the square. _____

d. Mason thinks that the flare will reach 15 meters in 5.4 seconds. Is he correct? Explain.

_____

e. Sean thinks the flare will reach 15 meters sooner, but then the flare will stay above 15 meters for about 5 seconds. Is he correct? Explain.

_____

2. Sean wants to know how high the flare will reach above the surface of the water.

a. Write the function in vertex form, factoring so the coefficient of t^2 is 1. _____

b. Complete the square using the vertex form of the function. _____

c. How high will the flare reach? _____

Choose the letter for the best answer.

3. Use the vertex form of the function to determine how long after firing the flare it will reach its maximum height.

A 3 s

B 5 s

C 9 s

D 15 s

4. The boys fire a similar flare from the deck 5 meters above the water level. Which statement is correct?

A The flare will reach 45 m in 3 s.

B The flare will reach 50 m in 3 s.

C The flare will reach 45 m in 3.5 s.

D The flare will reach 50 m in 3.5 s.

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Sean and Mason run out of gas while fishing from their boat in the bay. They set off an emergency flare with an initial vertical velocity of 30 meters per second. The height of the flare in meters can be modeled by $h(t) = -5t^2 + 30t$, where t represents the number of seconds after launch.

1. Sean thinks the flare should reach at least 15 meters to be seen from the shore. They want to know how long the flare will take to reach this height.

a. Write an equation to determine how long it will take the flare to reach 15 meters.

$15 = -5t^2 + 30t$

b. Simplify the function so you can complete the square.

$t^2 - 6t = -3$

c. Solve the equation by completing the square.

$t = 0.6, 5.4$

d. Mason thinks that the flare will reach 15 meters in 5.4 seconds. Is he correct? Explain.

Possible answer: He is partially correct. The flare will first reach 15 meters at 0.6 second after firing and then again at 5.4 seconds. (The function has two solutions.)

e. Sean thinks the flare will reach 15 meters sooner, but then the flare will stay above 15 meters for about 5 seconds. Is he correct? Explain.

Possible answer: He is correct. The flare will first reach 15 meters at 0.6 second after firing. Also, the difference between 5.4 and 0.6 seconds (the two solutions) is 4.8 seconds, which is about 5 seconds.

2. Sean wants to know how high the flare will reach above the surface of the water.

a. Write the function in vertex form, factoring so the coefficient of t^2 is 1.

$h(t) = -5(t^2 - 6t + 9) + 45$

b. Complete the square using the vertex form of the function.

$h(t) = -5(t - 3)^2 + 45$

c. How high will the flare reach?

The constant term; 45 meters

Choose the letter for the best answer.

3. Use the vertex form of the function to determine how long after firing the flare it will reach its maximum height.

(A) 3 s

B 5 s

C 9 s

D 15 s

4. The boys fire a similar flare from the deck 5 meters above the water level. Which statement is correct?

A The flare will reach 45 m in 3 s.

(B) The flare will reach 50 m in 3 s.

C The flare will reach 45 m in 3.5 s.

D The flare will reach 50 m in 3.5 s.