

# MeTEOR Performance Task

## Algebra I

Mathematics

*Quadratics in Volleyball*



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**MeTEOR**  
CONNECTING THE DOTS

## Performance Task Item: Quadratics and Volleyball

### Task/Question 1:

- A.** Write a quadratic equation in standard form:
- B.** Name four ways to solve quadratic equations:
- C.** You can derive the Quadratic Formula by \_\_\_\_\_ the  
\_\_\_\_\_.
- D.** List the three steps in completing the square if the  $x^2$ -coefficient equals 1.  
First Step: \_\_\_\_\_  
Second Step: \_\_\_\_\_  
Third Step: \_\_\_\_\_

Add a constant to complete each square:

- E.**  $x^2 + 10x +$  \_\_\_\_\_     $x^2 - 12x +$  \_\_\_\_\_     $x^2 + 5x +$  \_\_\_\_\_     $x^2 - 3x +$  \_\_\_\_\_

**Task/Question 2:**

**A.** Write the Quadratic Formula:

**B.** What do we call the quantity  $b^2 - 4ac$  when found under the radical sign?

**C.** When  $b^2 - 4ac$  is negative, you get two \_\_\_\_\_ solutions.

**D.** Use the Quadratic Formula to solve the following equations:

$$x^2 + x - 30 = 0 \quad \underline{\hspace{2cm}}$$

$$x^2 + 12x + 36 = 0 \quad \underline{\hspace{2cm}}$$

$$5x^2 - 35x + 50 = 0 \quad \underline{\hspace{2cm}}$$

$$5x^2 - 13x - 6 = 0 \quad \underline{\hspace{2cm}} \text{ (nearest tenth)}$$

**E.** Use  $d = rt - 5t^2$  for the following vertical motion problem where  $d = \text{distance}$ ,  $r = \text{rate}$  and  $t = \text{time}$ .

The engineers at the practice range are launching a new missile to check its altitude, times at various heights and when it will return to the ground. The missile is launched with an initial upward velocity of 100m/sec.

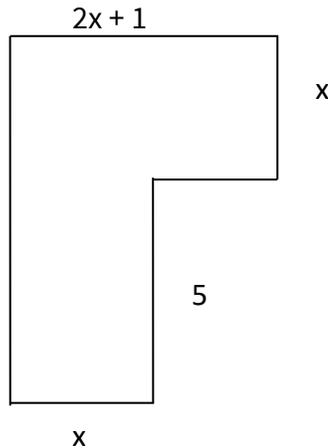
Calculate the altitude after 3 seconds:

At what time(s) will it be 480 meters high?

When does the missile return to the ground?

**Task/Question 3:**

Phoebe had an area of her property enclosed for her two goats to graze and play upon. To avoid cutting down the trees, they put her fence up to look like the diagram shown below. The total area enclosed is 80 square meters.



- A.** Find the value of  $x$  using the quadratic formula:
  
- B.** Explain how you found your answer to Part A:
  
- C.** Phoebe decided to cut down the trees in Part A to make the fenced in area larger. This would give the goats a lot more room to graze upon and play. The new shape would make a rectangle for the goats.

What will the new total area be in square meters?

- D.** Explain how you got your answer to Part C:

**Task/Question 4:**

Brittany, a volleyball player for the Yellow Jackets, served an underhanded volleyball in a final attempt to score a point against the Knights. The ball leaves her hand 1 meter above the floor and travels at an upward velocity of 7m/sec. She is successful. No one is able to stop the ball and it hits the ground on the Knight's side and she scores the winning point.

(Use  $d = rt - 5t^2$ , where  $d = \text{distance}$ ,  $r = \text{rate}$  and  $t = \text{time}$  to aid in solving this problem.)

- A. How high above the floor was the ball after 0.3 seconds?
- B. When was the ball back to the level where it was served before hitting the ground?
- C. How long did it take to hit the floor?
- D. The ball reached its highest level halfway between the time it was served and the time it was back at the level it was served from. How high is that above the floor?
- E. Explain how you determined the answer to Part D. Justify and defend how your approach to solving this is the **most efficient**.



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