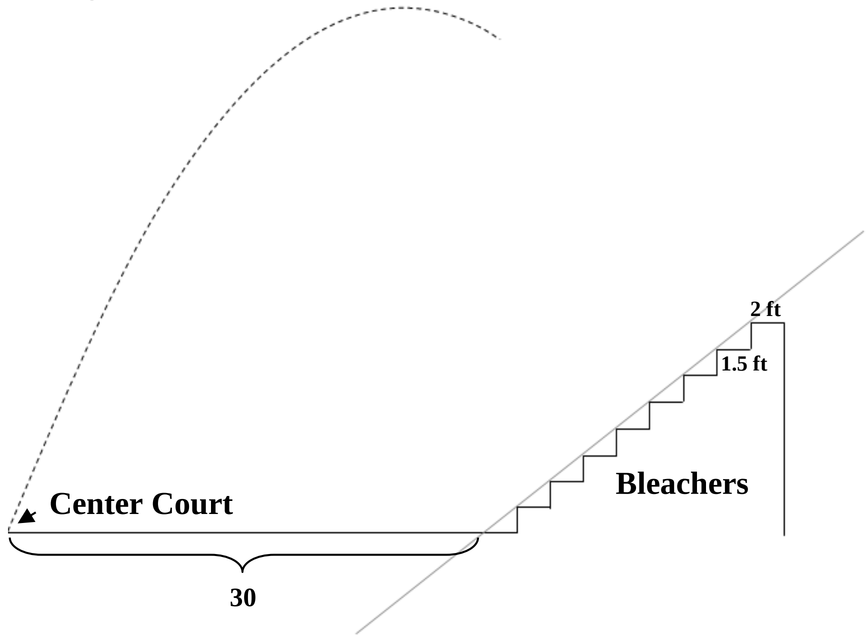
Name: ______________________________ Date: ________________

## Flying T-Shirts

At a Varsity Basketball game, free T-shirts are being shot into the audience from a floor launcher. Chan wants to make sure his girlfriend catches the T-shirt, so they need to figure out which bleacher row she should sit in. Chan launches from center court. The T-shirt's travel path, according to the manufacturer's manual, is represented by the equation $y = -0.05x^2 + 2.5x$, where $y$ represents the vertical height in feet in terms of the horizontal distance traveled, $x$, in feet.

The bleachers begin 32 feet from center court and each bleacher row has a height of 1.5 feet and a width of 2 feet as shown in the diagram. Use a line to represent the bleachers which touches the front edge of each row of seat and touches the floor 30 feet from center court as shown in the diagram. The diagram is not necessarily drawn to scale.




**1.** If the center court is represented by the origin on a coordinate plane, what is the equation for the line that touches the front edge of each of the bleachers?

**2.** What row should Chan tell his girlfriend to sit in to get the T-shirt? Explain how you determined your answer.

**3.** An equivalent form of the T-shirt's travel path $y = -0.05x^2 + 2.5x$ is $y = -0.05(x-25)^2 + 31.25$. What form of the equation is the new form? Confirm they are equivalent.

**4.** What do you notice about the coefficient in the equation $y = -0.05(x-25)^2 + 31.25$ and key points about the T-shirts path?

**5.** How do you think the equation $y = -0.05(x-25)^2 + 31.25$ would change if the T-shirt reached a maximum height of 40 feet? Justify your reasoning.

| **Flying T-Shirts** | | Rubric |
|---|---|---|
| The core elements of performance required by this task are:<br>• Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.<br><br>Based on these, credit for specific aspects of performance should be assigned as follows. | points | section points |
| 1. Gives correct answer: $\boldsymbol{y = \frac{3}{4}x - 22.5}$ | 1 | 1 |
| 2. Gives correct answer: **8th row**<br><br>Gives a correct explanation such as:<br>The point of intersection is (45,11.25), which means that the t-shirt has travelled 45 ft. horizontally when it strikes the line representing the bleachers at a height of 11.25 ft. This places the shirt in the **8th row** by this logic:<br><br>This point would be 45-30=15 ft into the bleachers horizontally which would place in the 8th row. Each row is 2ft wide so 15 ft would be in the middle of the 8th row, which ends at 16 ft. | 1<br><br>1 | 2 |
| 3. Gives correct answer: **Vertex form**<br><br>Shows work to prove the equations are equivalent | 1<br><br>1 | 2 |
| 4. Gives correct answers such as:<br>• The coefficient of the $x^2$ is the same.<br>• The number subtracted from x in the parenthesis is the horizontal location of the maximum.<br>• The number added at the end is the vertical maximum height. | 1<br><br>1<br><br>1 | 3 |
| 5. Gives correct answer such as:<br>$\boldsymbol{y = -.05(x - 25)^2 + 40}$<br>This makes the flight a little unrealistic, as the initial height would be 8.5 ft. | 1 | 1 |
| **Total Points** | | **9** |