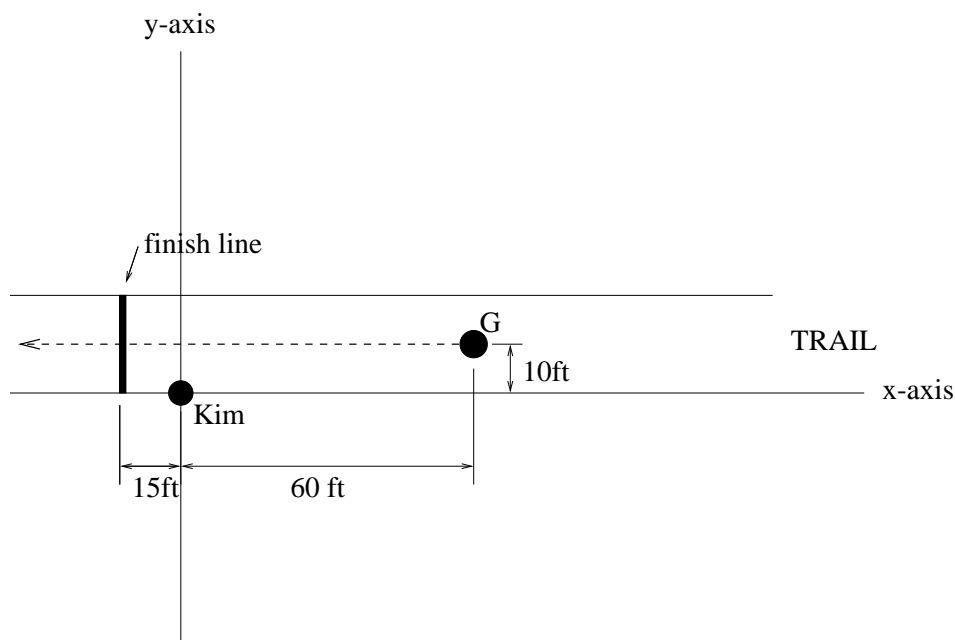


Instructions: You have 25 minutes for this quiz. You **MUST** show work for credit. No credit for answers only. If in doubt, ask for clarification. Six short questions about one situation.

Kim is standing by the side of a running trail and spots Grant at the location G pictured; the picture is “looking down from above”. Assume that Grant runs with a speed of 15 feet/sec to the left along the pictured dotted line; this dotted line is parallel to the edges of the trail. Kim does not move.



1. (3pt) Find the distance between Kim and Grant's location G.

Impose coordinates as pictured. Kim = (0,0), G = (60,10), apply distance formula:

$$d = \sqrt{(0 - 60)^2 + (0 - 10)^2} = \sqrt{3600 + 100} = \sqrt{3700} = 60.828 \text{ ft.}$$

2. (3pt) What is Grant's pace in units of min/mile?

$$\text{pace} = \frac{1}{15 \text{ ft/sec}} = \frac{1}{15} \text{ sec/ft} = (1/15)(\text{min}/60\text{sec})(5280 \text{ ft/mile}) = 5.867 \text{ min/mile.}$$

3. (3pt) When does Grant cross the finish line?

Use “distance = rate  $\times$  time”. Distance to finish line is 75 feet and rate is 15 ft/sec. Need to solve:  
 $75 = 15t$ . Get  $t = 5$  seconds.

4. (3pt) Find a formula for the distance between Kim and Grant after  $t$  seconds have elapsed.

Grant will travel  $15t$  feet to the left after  $t$  seconds. That means his x-coordinate will be calculated as:

starting x-coord - dist traveled =  $60 - 15t$ .

Grant's y-coord is always 10, so after  $t$  sec, Grant located at  $(60 - 15t, 10)$ . Kim still at  $(0, 0)$ . Use distance formula:

$$d = \sqrt{(60 - 15t - 0)^2 + (10 - 0)^2} = \sqrt{(60 - 15t)^2 + 100}.$$

5. (5pt) Find the two times when Grant is a distance of 15 feet from Kim.

Need to solve the equation:  $d=15$ . Using previous question, get:

$$\begin{aligned} 15 &= \sqrt{(60 - 15t)^2 + 100} \\ 15^2 &= (60 - 15t)^2 + 100 \\ 125 &= (60 - 15t)^2 \\ \pm\sqrt{125} &= 60 - 15t \\ 15t &= 60 \pm \sqrt{125} \\ t &= \frac{60 \pm \sqrt{125}}{15} = 4.745, 3.255. \end{aligned}$$

Conclude Grant is 15 feet from Kim at two times: 3.255 seconds and 4.745 seconds after being spotted at the position G.

6. (3pt) Find the location of Grant the first time he is a distance of 15 feet from Kim. (Describe his coordinates.)

By previous question, Grant is first 15 feet away at time 3.255 seconds. By 4., we know Grant's location after  $t$  seconds is  $(60 - 15t, 10)$ , so his location at time 3.255 is

$$(60 - 15(3.255), 10) = (11.175, 10).$$