

1. (10 points) A circular puddle has radius 3 feet. Harry, the guinea pig, plans to walk through the puddle and cool off.

Harry is located 5 feet east and 4 feet north of the center of the puddle and he plans to walk directly toward the westernmost edge of the puddle. Harry walks at a constant speed of 1.3 ft/sec.

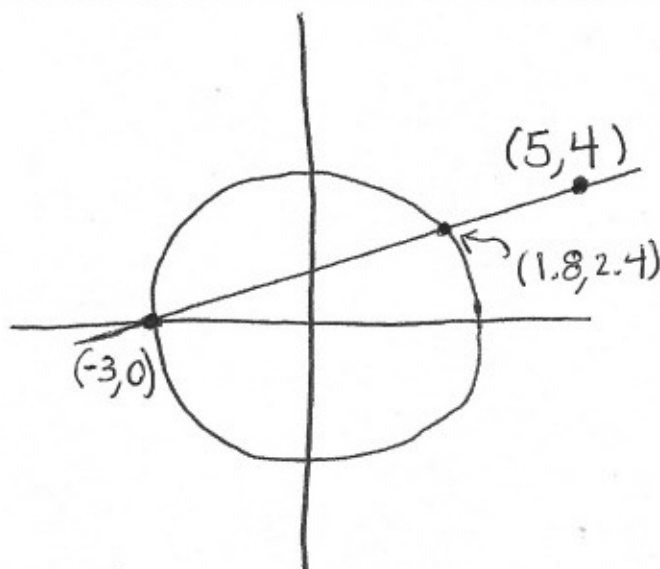
How long, in seconds, will it take Harry to first enter the puddle?

**circle**:  $x^2 + y^2 = r^2$ ,  $r = 3$

$x^2 + y^2 = 9$

**line**:  $y = m(x - x_1) + y_1$ ,  $m = \frac{4-0}{5-(-3)} = \frac{1}{2}$

$y = \frac{1}{2}(x + 3)$



**INTERSECTION**

$x^2 + \left[\frac{1}{2}(x+3)\right]^2 = 9$

$x^2 + \frac{1}{4}(x^2 + 6x + 9) = 9$

$1.25x^2 + 1.5x + 2.25 = 9$

$1.25x^2 + 1.5x - 6.75 = 0$

**Quadratic Formula**

$x = \frac{-1.5 \pm \sqrt{(1.5)^2 - 4(1.25)(-6.75)}}{2(1.25)}$

$x = \frac{-1.5 \pm \sqrt{31.5}}{2.5}$

$x = \frac{-1.5 \pm 6}{2.5}$

$x = -3$  or  $x = 1.8$

$y = 0$  or  $y = \frac{1}{2}(1.8 + 3)$

$y = 2.4$

**TIME TO ENTER PUDDLE**

$\text{time} = \frac{\text{dist}}{\text{speed}} = \frac{\sqrt{(5-1.8)^2 + (4-2.4)^2}}{1.3 \text{ ft/sec}} \approx 2.752084 \text{ sec}$

**2.75 seconds**

2. (10 points) A tour boat for whale watchers is sitting in one spot out on the ocean. The boat has a radar that will detect any whale within a radius of 4 miles. A whale is currently located 4 miles west and 6 miles south of the boat. The whale travels directly toward the easternmost edge of the radar zone at 10 mph. How long (in hours) will the whale be in the radar zone?

Circle:  $x^2 + y^2 = 4^2$

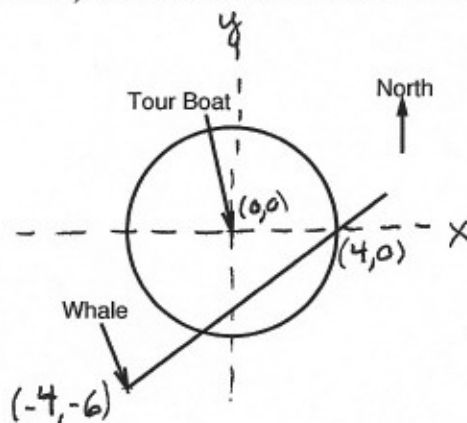
Line:  $m = \frac{0 - -6}{4 - -4} = \frac{6}{8} = 0.75$

$y = 0.75(x - 4) + 0$

ALSO CAN WRITE AS

$y = 0.75(x + 4) + -6$  and

$y = 0.75x - 3$



Note: Other origins may be used. This will effect the equations of the circle and line, but the technique and final answer are still the same.

Intersection

$$x^2 + (0.75x - 3)^2 = 4^2$$

$$x^2 + 0.5625x^2 - 4.5x + 9 = 16$$

$$1.5625x^2 - 4.5x - 7 = 0$$

$$x = \frac{4.5 \pm \sqrt{(-4.5)^2 - 4(1.5625)(-7)}}{2(1.5625)} = \frac{4.5 \pm 8}{3.125}$$

$$x = -1.12 \quad \text{or} \quad x = 4$$

$$y = 0.75(-1.12) - 3 = -3.84 \quad y = 0$$

Time

$$\text{Time} = \frac{\text{Dist}}{\text{Speed}} = \frac{\sqrt{(4 - -1.12)^2 + (0 - -3.84)^2}}{10}$$

$$= \frac{\sqrt{40.96}}{10} = \frac{6.4}{10} = \boxed{0.64 \text{ hours}}$$