

# \* Answer Key \*

Name: \_\_\_\_\_  
Math 190-EF

11/2/2016  
Exam 2

**Directions** Answer all questions in the space provided. Show all work and box your final answers. Answers with no work shown will not receive full credit. Good luck!

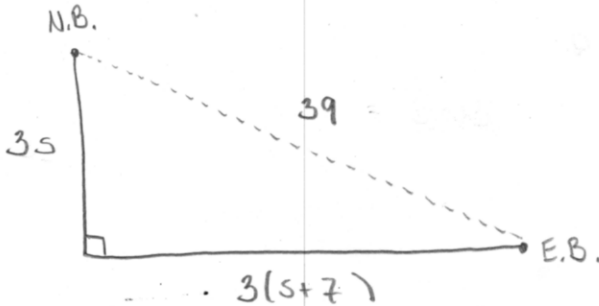
1. (8 points) Two fishing boats depart a harbor at the same time, one traveling east, the other north. The eastbound boat travels at a speed 7 mi/h faster than the northbound boat. After 3 h the boats are 39 mi apart. Find the speed of the northbound boat.

LET  $s$  = SPEED OF NORTHBOUND BOAT

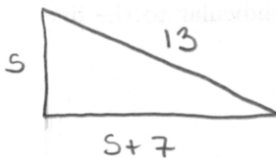
$s + 7$  = SPEED OF EASTBOUND BOAT

	SPEED	TIME	DISTANCE
N.B.	$s$	3	$3s$
E.B.	$s + 7$	3	$3(s + 7)$

( DISTANCE = SPEED  $\times$  TIME )



SCALE BY  $\frac{1}{3}$



PYTHAGOREAN THEOREM:

$$s^2 + (s + 7)^2 = 13^2$$

$$s^2 + s^2 + 14s + 49 = 169$$

$$2s^2 + 14s - 120 = 0$$

$$2(s^2 + 7s - 60) = 0$$

$$2(s + 12)(s - 5) = 0$$

↓  
 $s = -12$

(REJECT)

↓  
 $s = 5$

2. Consider the three points  $P(3, -5)$ ,  $Q(-2, 7)$ , and  $R(1, -1)$ .

(a) (4 points) Find the distance between  $P$  and  $Q$ .

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$d = \sqrt{(-2 - 3)^2 + (7 + 5)^2}$$

$$d = \sqrt{25 + 144} = \sqrt{169} = \boxed{13}$$

(b) (4 points) Find the slope of the line through  $P$  and  $Q$ .

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7 + 5}{-2 - 3} = \boxed{-\frac{12}{5}}$$

(c) (4 points) Give an equation for the line that passes through  $R$  and is perpendicular to the line through  $P$  and  $Q$ .

$$\text{Slope } -\frac{12}{5} \xrightarrow{\perp} \frac{5}{12}$$

Point-Slope Formula:  $y - y_1 = m(x - x_1)$

$$\boxed{\begin{array}{l} y + 1 = \frac{5}{12}(x - 1) \\ \text{or} \\ y = \frac{5}{12}x - \frac{17}{12} \end{array}}$$

3. (8 points) Find the center and radius of the circle described by the following equation.

$$x^2 + y^2 + 10x - 4y + 28 = 0$$

$$x^2 + 10x + y^2 - 4y = -28$$

$$x^2 + 10x + 25 + y^2 - 4y + 4 = -28 + 25 + 4 = 1$$

$$(x + 5)^2 + (y - 2)^2 = 1$$

Center: $(-5, 2)$
RADIUS: 1

4. (a) (4 points) Give an equation for the horizontal line through  $(-11, 8)$ .

$$y = 8$$

- (b) (4 points) Give an equation for the vertical line through  $(-11, 8)$ .

$$x = -11$$

5. (4 points) Consider the following piecewise-defined function.

$$g(x) = \begin{cases} 2x - 3 & \text{if } x < -1 \\ -x^2 & \text{if } -1 \leq x < 2 \\ \frac{1}{2}x + 4 & \text{if } 2 \leq x \end{cases}$$

Find the values of  $g(-2)$ ,  $g(-1)$ ,  $g(0)$ ,  $g(2)$ , and  $g(3)$ .

$$g(-2) = 2(-2) - 3 = -4 - 3 = \boxed{-7}$$

$$g(-1) = -(-1)^2 = \boxed{-1}$$

$$g(0) = -(0)^2 = \boxed{0}$$

$$g(2) = \frac{1}{2}(2) + 4 = \boxed{5}$$

$$g(3) = \frac{1}{2}(3) + 4 = \boxed{\frac{11}{2}}$$

6. (8 points) Let  $f(x) = 5x^2 - 4x + 2$ . Find and simplify the difference quotient  $\frac{f(a+h) - f(a)}{h}$ .

$$\frac{f(a+h) - f(a)}{h} = \frac{5(a+h)^2 - 4(a+h) + 2 - (5a^2 - 4a + 2)}{h}$$

$$= \frac{\cancel{5a^2} + 10ah + 5h^2 - \cancel{4a} - 4h + \cancel{2} - \cancel{5a^2} + \cancel{4a} - \cancel{2}}{h}$$

$$= \frac{\cancel{h}(10a + 5h - 4)}{\cancel{h}}$$

$$= \boxed{10a + 5h - 4}$$