

Midterm # 1 A Solutions

The BCS System

November 12, 2009

Hi everyone! Here are the solutions to the Math 110 Exam of Happiness A!!! Enjoy!

- (a) $f(-1) = \sqrt{1 + (-1)^2} = \sqrt{2}$.
(b) The only y -intercept is at $y = 1$.
(c) The function is even, since

$$f(-x) = \sqrt{1 + (-x)^2} = \sqrt{1 + x^2} = f(x).$$

- (a) Shift the graph 4 units to the left.
(b) Reflect the graph over the y -axis, and compress the graph towards the y -axis by a factor of 3.
(c) Scale vertically the graph by a factor of 3, and then shift the graph up 1 unit.
- The distance between the points P and Q is

$$\sqrt{(-1 - 7)^2 + (5 - 2)^2} = \sqrt{(-8)^2 + 3^2} = \sqrt{73}.$$

- We complete the square on the x 's to see that

$$x^2 + 6x = x^2 + 6x + 9 - 9 = (x + 3)^2 - 9.$$

Completing the square with the y 's gives us

$$y^2 - 10y = y^2 - 10y + 25 - 25 = (y - 5)^2 - 25.$$

So finally we have

$$2 = x^2 + 6x + y^2 - 10y = (x + 3)^2 - 9 + (y - 5)^2 - 25,$$

So,

$$36 = (x + 3)^2 + (y - 5)^2.$$

Thus, the center of the circle is at $(-3, 5)$ and the radius is $\sqrt{36} = 6$.

5. This line has slope 3, and goes through (8, 2), so the equation is

$$y - 2 = 3(x - 8).$$

6. This line has slope $-\frac{1}{4}$, and goes through (4, 5), so the equation is

$$y - 5 = -\frac{1}{4}(x - 4).$$

7. (a) $(f + g)(1) = f(1) + g(1) = [(1)^2 - 1] + [(2(1) - 5)] = 0.$

(b) The rule would be

$$(f \cdot g)(x) = f(x)g(x) = (x^2 - 1)(2x - 5).$$

(c) The rule would be

$$(f \circ g)(x) = f(g(x)) = f(2x - 5) = (2x - 5)^2 - 1.$$

8. (a) We notice that

$$-4x^2 - 16x = -4(x^2 + 4x) = -4(x^2 + 4x + 4 - 4) = -4[(x + 2)^2 - 4] = -4(x + 2)^2 + 16.$$

So

$$-4x^2 - 16x - 17 = -4(x + 2)^2 + 16 - 17 = -4(x + 2)^2 - 1.$$

(b) The vertex is at $(-2, -1)$, and the graph is pictured below.

