

## Math 22 Section 9

### Quiz 2 Solutions

1. Write the following in the form  $a + bi$ :

(a)  $(5 - 2i)(3 + i)$

$$(5 - 2i)(3 + i) = 15 + 5i - 6i - 2i^2 = 15 - i + 2 = 17 - i$$

(b)  $\frac{4-6i}{1+5i}$

$$\frac{4-6i}{1+5i} = \frac{4-6i}{1+5i} \frac{1-5i}{1-5i} = \frac{4-20i-6i+30i^2}{1^2+5^2} = \frac{-26-26i}{26} = -1 - i$$

2. Find the distance between the points  $(6, 3)$  and  $(5, 0)$ .

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(5 - 6)^2 + (0 - 3)^2} = \sqrt{(-1)^2 + (-3)^2} = \sqrt{1 + 9} = \sqrt{10}$$

3. Solve the inequality. Express the solution as an interval.

$$\frac{x + 2}{x + 3} \leq 0$$

0 is already isolated on the RHS, so we can immediately make our table. The numerator has a zero at  $x = -2$  and the denominator has a zero at  $x = -3$ , so our test intervals are  $(-\infty, -3)$ ,  $(-3, -2)$ , and  $(-2, \infty)$ .

	$(-\infty, -3)$	$(-3, -2)$	$(-2, \infty)$
$x + 2$	-	-	+
$x + 3$	-	+	+
$\frac{x+2}{x+3}$	+	-	+

Since  $-2$  is a zero of  $\frac{x+2}{x+3}$ , we include it in the interval. However, the function is undefined at  $x = -3$ , so this should not be included. Thus, the inequality holds for  $x \in (-3, -2]$

4. The gas milage  $g$  (in mi/gal) for a vehicle driven at  $v$  mi/hour is given by the formula  $g = 30 - .1v$ . For what range of speeds is the milage 25mi/gal or better?

The variable is  $v$ . The only relation we need is  $g \geq 25$ .

$$\text{i.e. } 30 - .1v \geq 25 \iff 30 - 25 \geq .1v \iff 5 \geq .1v \iff v \leq 50$$

So the gas milage is 25mi/gal or better when the car is being driven less than 50mph.

5. Find all solutions to

$$\left(\frac{x+1}{x}\right)^2 + 4\left(\frac{x+1}{x}\right) + 3 = 0$$

Upon making the substitution  $w = \frac{x+1}{x}$ , we get the quadratic equation  $w^2 + 4w + 3 = 0$ , which is easily factored as  $(w + 1)(w + 3) = 0$ .

Thus,  $w = -1$  OR  $w = -3$

From our substitution,  $w = -1$  implies:

$$\begin{aligned} \frac{x+1}{x} = -1 &\iff x + 1 = -x, x \neq 0 \iff 2x = -1, \\ x \neq 0 &\iff x = -\frac{1}{2} \end{aligned}$$

and  $w = -3$  implies:

$$\begin{aligned} \frac{x+1}{x} = -3 &\iff x + 1 = -3x, x \neq 0 \iff 4x = -1, \\ x \neq 0 &\iff x = -\frac{1}{4} \end{aligned}$$

So the equation has the two solutions  $x = -\frac{1}{2}$  and  $x = -\frac{1}{4}$ .