Find all real or imaginary solutions in #s 1 – 5..

1. (5 pts) $-3x - 7 = 2x + 21$

$$-5x = 28$$

$$x = -\frac{28}{5}$$

$$x \in \left\{ -\frac{28}{5} \right\}$$

2. (5 pts) $\frac{3}{5}x - \frac{2}{3} = \frac{5}{6}$ $LCD = 2 \cdot 3 \cdot 5$

$$\frac{6}{6} \cdot \frac{3x}{5} - \frac{10}{10} \cdot \frac{2}{3} = \frac{5}{5} \cdot \frac{5}{6}$$

$$\frac{18x - 20}{LCD} = \frac{25}{LCD}$$

$$18x - 20 = 25$$

$$18x = 45$$

$$x = \frac{45}{18} = \frac{15}{6} = \frac{5}{2} = x$$

$$x \in \left\{ \frac{5}{2} \right\}$$

3. (5 pts) $9x^2 = 7$

$$x^2 = \frac{7}{9}$$

$$x = \pm \frac{\sqrt{7}}{3}$$

$$x \in \left\{ \pm \frac{\sqrt{7}}{3} \right\}$$

4. (5 pts) $5x^2 - 10x + 17 = 0$ (Rationalize denominator at the end.)

$$5(x^2 - 2x + 1) = -17 + 5$$

$$5(x-1)^2 = -12$$

$$(x-1)^2 = \frac{-12}{5}$$

$$x - 1 = \pm i \sqrt{\frac{12}{5}} = \pm i \frac{2\sqrt{3}}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}}$$

$$= \pm \frac{2i\sqrt{15}}{5}$$

$$x \in \left\{ 1 \pm \frac{2i\sqrt{15}}{5} \right\}$$

5. (10 pts) Compute the discriminant for each of the following equations and tell me what it tells you about the solutions of the equations, *without having to solve them*, i.e., don't solve.

   a. $10x^2 + 81x - 133 = 0$

   b. $25x^2 - 50x + 28 = 0$

$b^2 - 4ac = 81^2 - 4(10)(-133)$

$= 11881$

$= 109^2$

Two, nonequal, rational zeros.

$b^2 - 4ac = (-50)^2 - 4(25)(28)$

$= -300$

Two, nonequal, nonreal zeros.

6. (10 pts) Solve $x^2 + 12x - 17 = 0$ by completing the square.

$x^2 + 12x \qquad = 17$

$x^2 + 12x + 6^2 = 17 + 36$

$(x + 6)^2 = 53$

$x + 6 = \pm \sqrt{53}$

$\boxed{x = -6 \pm \sqrt{53}}$

7. (5 pts) Find an equation of the line through $(2,5)$ and $(3,-7)$. Point-slope is preferred, but not required.

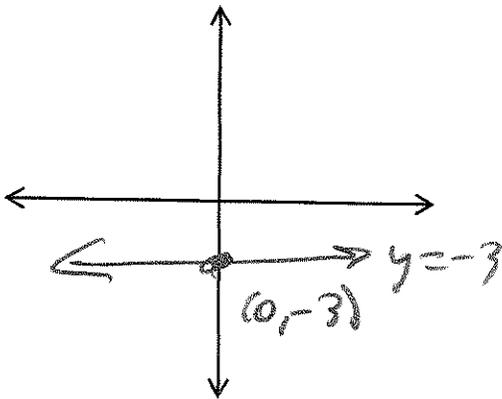$m = \dfrac{-7-5}{3-2} = \dfrac{-12}{1} = -12$

$\boxed{y = -12(x-2) + 5}$

8. (5 pts) Find an equation of the line thru $(8,-6)$ that is parallel to the line $y = 3x - 11$.
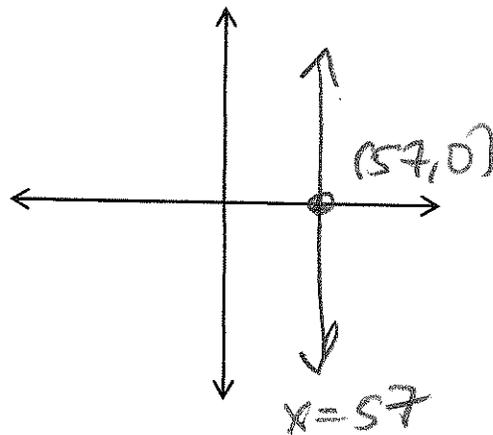
$$y = 3(x-8)-6$$

9. (5 pts) Find an equation of the line thru $(8,-6)$ that is *perpendicular* to the line $y = 3x - 11$.

$$y = -\frac{1}{3}(x-8)-6$$

10. (5 pts) Sketch the graph of the line $y = -3$

$y = -3$
$(0,-3)$

11. (5 pts) Sketch the graph of the line $x = 57$

$(57,0)$
$x = 57$

Solve the inequalities. Give you answer as a set and as an interval. You may want to use a number line graph to help you write your answer, but it is not required.

12. (5 pts) $-5x - 4 > 34$

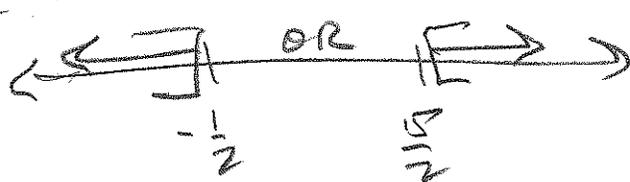$$-5x > 38$$

$$\left\{ x \mid x < \frac{38}{-5} \right\}$$

$$= \left(-\infty, -\frac{38}{5}\right)$$

13. (5 pts) $|2x - 7| \geq 8$

$2x - 7 \geq 8$ OR $2x - 7 \leq -8$

$2x \geq 15$ OR $2x \leq -1$

$\{x \mid x \geq \frac{15}{2}$ OR $x \leq -\frac{1}{2}\} =$

$= (-\infty, -\frac{1}{2}] \cup [\frac{15}{2}, \infty)$

14. (5 pts) $|2x - 7| < 8$

$2x - 7 < 8$ AND $2x - 7 > -8$

$2x < 15$ AND $2x > -1$

$\{x \mid x < \frac{15}{2}$ and $x > -\frac{1}{2}\}$

 AND

$= (-\frac{1}{2}, \frac{15}{2})$

15. (5 pts) $|2x - 3| > -7$

$(-\infty, \infty)$

16. (5 pts) $|2x - 3| \leq -7$

$\emptyset$

17. (5 pts) How much 20% nitrate solution must be added to 50 liters of 50% nitrate solution to obtain a 34% nitrate solution?

Let $x =$ amt of 20% solution (l). Then

$.2x + .5(50) = .34(x + 50)$

$.2x + 25 = .34x + 17$

$-.14x = -8$

$x = \frac{8}{.14} \approx 57.14285714$

18. (5 pts) John can do a job in 12 hours that takes Bob 16 hours. Suppose John sleeps in on the day they were to work together and shows up 2 hours late. How many hours does Bob end up working, if they finish the job together? How many hours does John end up working that day?

Let $x = $ # of hours Bob works

$2|12$ $2|16$ $2^4 \cdot 3 = 48$
$2|6$ $2|8$
3 $2|4$
            2

$$\frac{1}{12}(x-2) + \frac{1}{16}x = 1$$

$$\frac{4}{4} \cdot \frac{x-2}{12} + \frac{3}{3} \cdot \frac{x}{16} = \frac{48}{48}$$
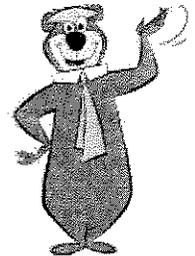
$$4x - 8 + 3x = 48$$

$$7x = 56$$

$$x = 8 \text{ hrs}$$

$$\longrightarrow \text{John works } 6 \text{ hours}$$

BONUS PROBLEMS

BONUS (10 pts) Re-write the function $f(x) = x^2 - 8x - 5$ in the form $f(x) = a(x-h)^2 + k$. State the vertex of this parabola.

BONUS (10 pts) Re-write the function $g(x) = 5x^2 + 10x - 19$ in the form $g(x) = a(x-h)^2 + k$. State the vertex of this parabola.

$x^2 - 8x - 5$

$= x^2 - 8x + 4^2 - 16 - 5$

$= (x-4)^2 - 21$

$(h, k) = (4, -21)$

$5x^2 + 10x - 19$

$= 5(x^2 + 2x \quad) - 19$

$= 5(x^2 + 2x + 1) - 19 + 5$

$= 5(x+1)^2 - 14$

$(h, k) = (-1, -14)$