

1. (5pts) Find the equation of the line that contains  $(-1, 3)$  and is parallel to the line  $3x - 2y = 4$ . Sketch both lines on the same coordinate system.

$$3x - 2y = 4$$

$$3x - 4 = 2y \quad | \div 2$$

$$\frac{3}{2}x - 2 = y$$

$$m = \frac{3}{2}$$

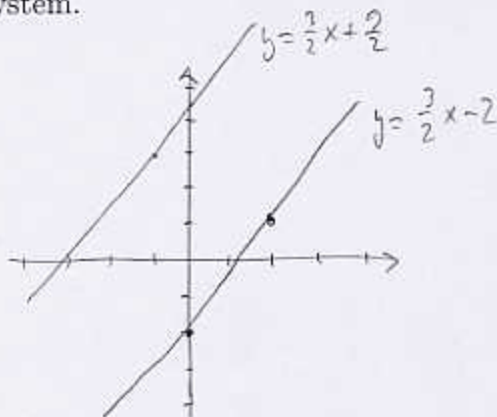
Slope of

parallel line:  $\frac{3}{2}$ 

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

$$y - 3 = \frac{3}{2}x + \frac{3}{2}$$

$$y = \frac{3}{2}x + \frac{9}{2}$$



2. (8pts) Solve the inequalities and write the solution in interval notation:

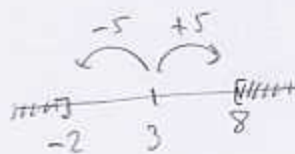
a)  $5 < 2x - 4 \leq 6$

$$9 < 2x \leq 10 \quad | \div 2$$

$$\frac{9}{2} < x \leq 5$$

$$x \in \left(\frac{9}{2}, 5\right]$$

b)  $|x - 3| \geq 5$

dist. from  $x$  to  $3 \geq 5$ 

$$x \in [8, \infty) \text{ or } x \in (-\infty, 2]$$

3. (3pts) Solve for  $t$ :

$$v = -gt + v_0$$

$$v - v_0 = -gt$$

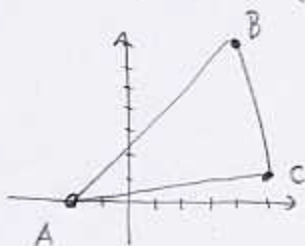
$$t = \frac{v_0 - v}{g}$$

$$\frac{v - v_0}{-g} = t$$

4. (4pts) Put the complex number into form  $a + bi$ .

$$\frac{i(3+2i)}{1+i} = \frac{3i-2}{1+i} \cdot \frac{1-i}{1-i} = \frac{3i-2-3i^2+2i}{1-i^2} = \frac{5i+1}{2} = \frac{1}{2} + \frac{5}{2}i$$

5. (5pts) Determine algebraically (Pythagorean theorem or another method) if the triangle with vertices  $A = (-2, 0)$ ,  $B = (4, 7)$  and  $C = (5, 1)$  is a right triangle.



$$d(A, B) = \sqrt{(7-0)^2 + (4-(-2))^2} = \sqrt{49+36} = \sqrt{85}$$

$$d(B, C) = \sqrt{(5-4)^2 + (1-7)^2} = \sqrt{1+36} = \sqrt{37}$$

$$d(A, C) = \sqrt{(5-(-2))^2 + (1-0)^2} = \sqrt{49+1} = \sqrt{50}$$

$$\text{Is } d(A, C)^2 + d(B, C)^2 = d(A, B)^2$$

$$\sqrt{50}^2 + \sqrt{37}^2 \stackrel{?}{=} \sqrt{85}^2$$

$50 + 37 \neq 85$  so not a right triangle

Or: check slopes of AC, BC

$$m_{AC} = \frac{1-0}{5-(-2)} = \frac{1}{7} \quad \leftarrow \text{not opposite reciprocals}$$

$$m_{BC} = \frac{1-7}{5-4} = -\frac{6}{1} = -6$$

AC, BC not perpendicular

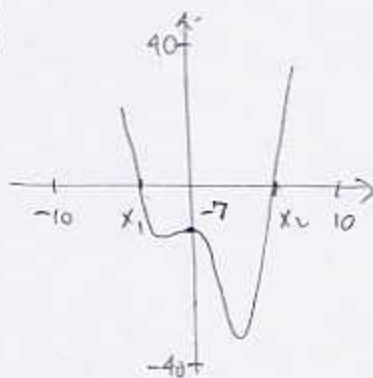
6. (5pts) The equation  $y = x^4 - 2x^3 - 5x^2 - x - 7$  is given.

a) Use your calculator to accurately sketch the graph of the equation on paper. Indicate your viewing window.

b) What is the  $y$ -intercept of the graph?

c) Using your calculator, find the smallest  $x$ -intercept accurate to three decimal points.

a)



b) When  $x=0$ ,  $y=-7$

c) Need  $x_1$ :  $x_1 \approx -1.770$

Solve the equations:

7. (4pts)  $x^2 - 3x + 15 = 0$

doesn't factor

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4 \cdot 1 \cdot 15}}{2} = \frac{3 \pm \sqrt{9-60}}{2} = \frac{3 \pm \sqrt{-51}}{2} = \frac{3 \pm \sqrt{51}i}{2}$$

8. (5pts)  $\sqrt{7-2x} = x-2 \quad |^2$

$$7-2x = x^2 - 4x + 4$$

$$x^2 - 2x - 3 = 0$$

$$(x-3)(x+1) = 0$$

$$x = 3 \text{ or } x = -1$$

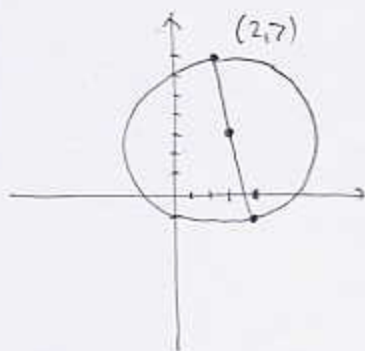
$$\sqrt{7-2 \cdot 3} \stackrel{?}{=} 3-2$$

$$\sqrt{1} = 1 \text{ yes}$$

$$\sqrt{7-2 \cdot (-1)} \stackrel{?}{=} -1-2$$

$$\sqrt{9} \stackrel{?}{=} -3 \text{ no}$$

9. (5pts) Find the equation of the circle whose diameter has endpoints at  $(2, 7)$  and  $(4, -1)$ . Sketch the circle. (Hint: what is the center? The radius?)



Midpt. of  $(2, 7)$  and  $(4, -1)$  is the center

$$C = \left( \frac{2+4}{2}, \frac{7-1}{2} \right) = (3, 3)$$

$$\text{radius} = d(C, (2, 7)) = \sqrt{(3-2)^2 + (3-7)^2} = \sqrt{1+16} = \sqrt{17}$$

$$\text{Equation: } (x-3)^2 + (y-3)^2 = 17$$

10. (6pts) How many liters of a 10% solution of green needs to be added to 20 liters of a 50% solution of green in order to get a 20% solution? Don't forget to write down what your variable means.

$$\begin{array}{|c|} \hline 10\% \text{ sol} \\ \hline x \text{ l} \\ \hline \end{array} + \begin{array}{|c|} \hline 50\% \text{ sol} \\ \hline 20 \text{ l} \\ \hline \end{array} = \begin{array}{|c|} \hline 20\% \\ \hline x+20 \\ \hline \end{array}$$

$x = \text{amt. of } 10\% \text{ sol. of green}$

pure green:  $0.1x + 0.2 \cdot 50 = 0.2(x+20)$

$$0.1x + 10 = 0.2x + 4$$

$$6 = 0.1x$$

$$x = 60 \text{ ltrs}$$

**Bonus** (5pts) It takes Batman 50 minutes to wipe out a gang of bad guys. Superman can finish with the same gang in 30 minutes (after all, he can fly!). How long would it take them if they worked together?

$T = \text{time it takes them together, in minutes}$

$$\frac{1}{50} + \frac{1}{30} = \frac{1}{T}$$

$$\frac{3+5}{150} = \frac{1}{T}$$

$$T = \frac{150}{8} = 18.75 \text{ minutes}$$