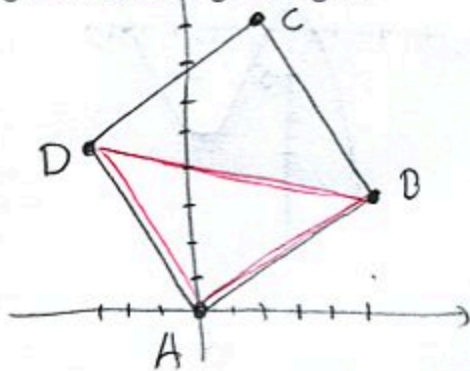1. (10pts) Let $A = (0,0)$, $B = (5,3)$, $C = (2,8)$ and $D = (-3,5)$. Draw the quadrangle $ABCD$ and then determine algebraically if it is a square by checking all sides have equal length and one angle is right.

lengths of sides:

$AB: \sqrt{(5-0)^2 + (3-0)^2} = \sqrt{25+9} = \sqrt{34}$

$BC: \sqrt{(2-5)^2 + (8-3)^2} = \sqrt{9+25} = \sqrt{34}$

$CD: \sqrt{(-3-2)^2 + (5-8)^2} = \sqrt{25+9} = \sqrt{34}$

$AD: \sqrt{(-3-0)^2 + (5-0)^2} = \sqrt{9+25} = \sqrt{34}$

all sides have equal length

Check angle at A using triangle ABD:

length of $BD: \sqrt{(-3-5)^2 + (5-3)^2} = \sqrt{64+4} = 68$

$\sqrt{34}^2 + \sqrt{34}^2 \overset{?}{=} \sqrt{68}^2$
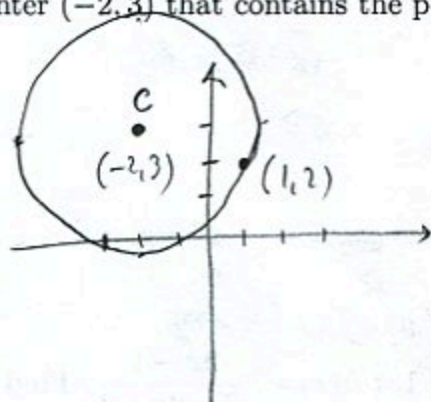
$34 + 34 = 68$ yes

It is a square

2. (8pts) Find the equation of the circle with center $(-2,3)$ that contains the point $(1,2)$. Draw the circle.

$r =$ distance from $(-2,3)$ to $(1,2)$
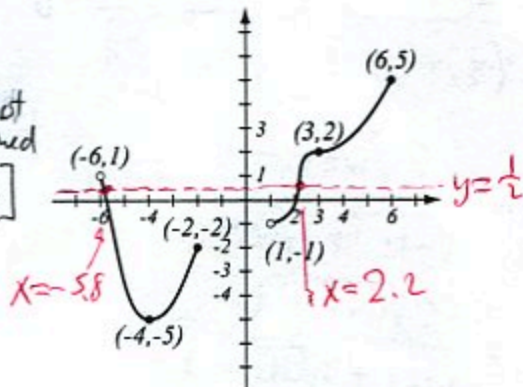
$= \sqrt{(-2-1)^2 + (3-2)^2} = \sqrt{9+1} = \sqrt{10}$

Eq: $(x-(-2))^2 + (y-3)^2 = \sqrt{10}^2$

$(x+2)^2 + (y-3)^2 = 10$

3. (8pts) Use the graph of the function f at right to answer the following questions.

a) Find $f(3)$ and $f(0)$. $f(3)=2$, $f(0)$ is not defined

b) What is the domain of f? $(-6,-2] \cup (1,6]$

c) What is the range of f? $[-4,5]$

d) What are the solutions of the equation $f(x) = \frac{1}{2}$?

$x = -5.8, 2.2$

4. (12pts) The function
$f(x) = x^3 - 5x^2 + x + 2$ is given.

a) Use your calculator to accurately
its graph. Draw the graph here, and
indicate units on the axes.

$y\text{-int} = f(0) = 2$

b) Find all the $x-$ and $y-$intercepts
(accuracy: 6 decimal points).

$x\text{-int}:$

c) State the domain and range.

$x_1 = -0.518987$

Domain: $(-\infty, \infty)$

$x_2 = 0.821806$

Range: $(-\infty, \infty)$

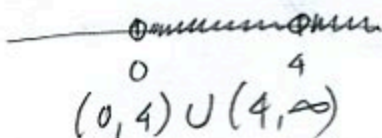$x_3 = 4.696393$

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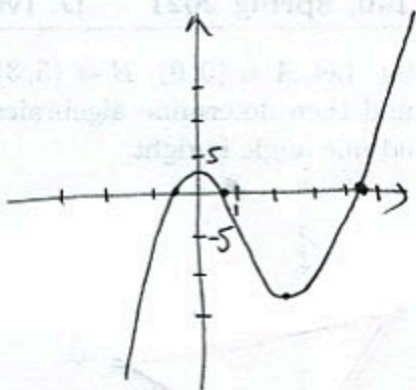
5. (12pts) Find the domain of each function and write it using interval notation.

$$f(x) = \frac{2}{(x-4)\sqrt{x}}$$

Can't have: $x - 4 = 0$, $x = 4$

$\sqrt{x} = 0$, $x = 0$

Must have $x \geq 0$

$(0, 4) \cup (4, \infty)$

$$g(x) = \frac{3x - 2}{x^2 - 4x - 21}$$

Can't have $x^2 - 4x - 21 = 0$

$(x - 7)(x + 3) = 0$

$x = 7, -3$

$(-\infty, -3) \cup (-3, 7) \cup (7, \infty)$

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6. (10pts) Let $h(x) = \dfrac{2x - 1}{x^2 + 3x - 1}$. Find the following (simplify where appropriate).

$h\left(\dfrac{1}{2}\right) = \dfrac{2 \cdot \frac{1}{2} - 1}{\left(\frac{1}{2}\right)^2 + 3 \cdot \frac{1}{2} - 1} = \dfrac{0}{\frac{3}{2} - \frac{3}{4}} = \dfrac{0}{-\frac{3}{4}} = 0$

$h(-2) = \dfrac{2(-2) - 1}{(-2)^2 + 3(-2) - 1} = \dfrac{-5}{-3} = \dfrac{5}{3}$

$h(\sqrt{w + 1}) = \dfrac{2\sqrt{w+1} - 1}{\sqrt{w+1}^2 + 3\sqrt{w+1} - 1}$

$= \dfrac{2\sqrt{w+1} - 1}{w+1 + 3\sqrt{w+1} - 1}$

$= \dfrac{2\sqrt{w+1} - 1}{w + 3\sqrt{w+1}}$

$h(x + 5) = \dfrac{2(x+5) - 1}{(x+5)^2 + 3(x+5) - 1}$

$= \dfrac{2x + 10 - 1}{x^2 + 10x + 25 + 3x + 15 - 1} = \dfrac{2x + 9}{x^2 + 13x + 39}$