College Algebra — Exam 1
MAT 140, Fall 2017 — D. Ivanšić

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Show all your work!

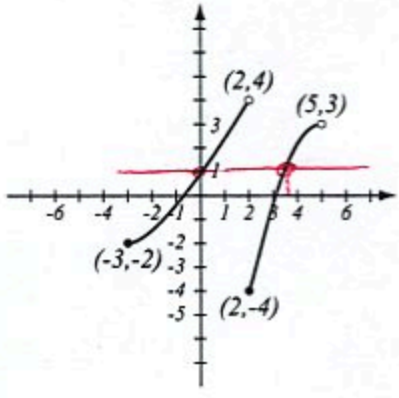
1. (8pts) Use the graph of the function f at right to answer the following questions.

a) Find: $f(-3) = -2$ $f(2) = 4$

b) What is the domain of f? $[-3, 5)$

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

d) What are the solutions of the equation $f(x) = 1$? $x = 0, 3.5$



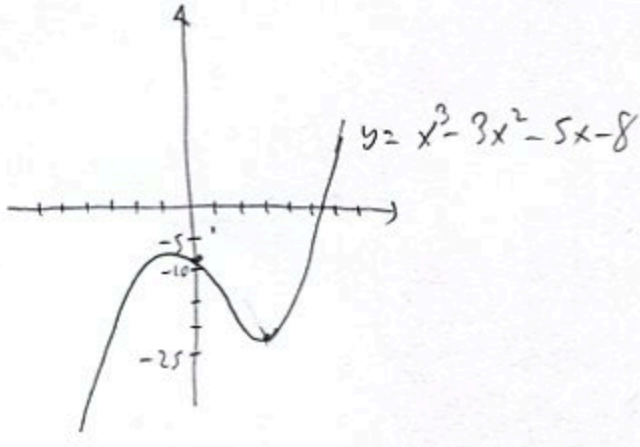
2. (10pts) Use your calculator to accurately sketch the graph of $y = x^3 - 3x^2 - 5x - 8$.

a) Draw the graph on paper and indicate units on the axes.

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

y-int: -8

x-int: 4.504341



3. (5pts) Write the equation of the line whose x-intercept is 2 and passes through $(7, 4)$.

Line through $(2,0)$ and $(7,4)$

$m = \frac{4-0}{7-2} = \frac{4}{5}$

$y - 0 = \frac{4}{5}(x-2)$

$y = \frac{4}{5}x - \frac{8}{5}$

4. (10pts) Find the equation of the line (in form $y = mx + b$) that is perpendicular to the line $4x - 3y = 6$ and passes through the y-intercept of the given line. Draw both lines.

$4x - 3y = 6$

$4x - 6 = 3y \mid \div 3$

$y = \frac{4}{3}x - 2$

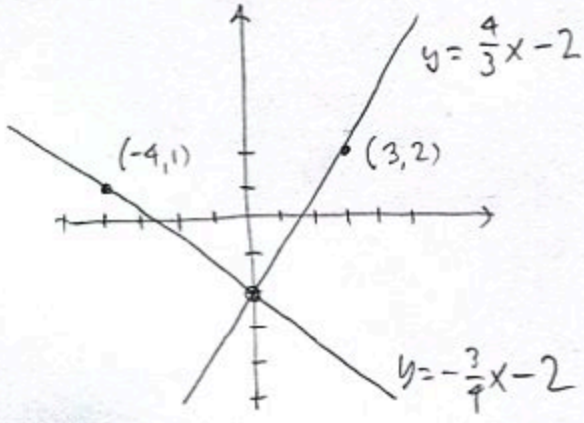
slope $= \frac{4}{3}$

y-int $= -2$

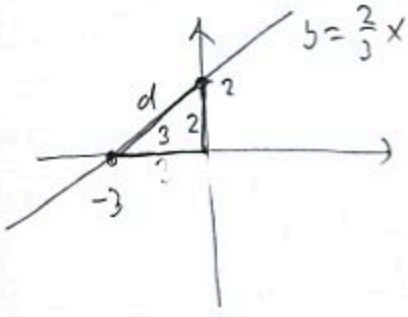
Perp. line has slope $-\frac{3}{4}$

$y - (-2) = -\frac{3}{4}(x - 0)$

$y = -\frac{3}{4}x - 2$



5. (7pts) Draw the line $y = \frac{2}{3}x + 2$. This line and the x- and y-axes determine a triangle. Find the perimeter of this triangle.



d = distance from $(-3,0)$ to $(0,2)$

Perimeter is $3 + 2 + d$

$= 5 + \sqrt{(0-(-3))^2 + (2-0)^2}$

$= 5 + \sqrt{13}$ $(\approx 8.605551$

6. (9pts) Let $f(x) = \dfrac{2x-5}{x^2-4x}$. Find the following (simplify where appropriate).

$g(4) = \dfrac{8-5}{16-16} = \dfrac{3}{0}$ not defined

$g(6) = \dfrac{12-5}{36-24} = \dfrac{7}{12}$

$g(-3x) = \dfrac{2(-3x)-5}{(-3x)^2-4(-3x)}$

$= \dfrac{-6x-5}{9x^2+12x}$

$g(u+1) = \dfrac{2(u+1)-5}{(u+1)^2-4(u+1)}$

$= \dfrac{2u+2-5}{u^2+2u+1-4u-4}$

$= \dfrac{2u-3}{u^2-2u-3}$

7. (10pts) Find the domains of the functions below and write them using interval notation.

$f(x) = \dfrac{4}{x^2+2x-15}$

Can't have: $x^2+2x-15=0$

$(x+5)(x-3)=0$

$x = -5, 3$

~~this other one~~

-5 3

$(-\infty,-5) \cup (-5,3) \cup (3,\infty)$

$g(x) = \dfrac{\sqrt{2x+5}}{2x-5}$

Can't have: $2x-5=0$

$2x=5$

$x=\frac{5}{2}$

Must have $2x+5 \geq 0$

$2x \geq -5$

$x \geq -\frac{5}{2}$

$-\frac{5}{2}$ $5/2$

$\left[-\frac{5}{2},\frac{5}{2}\right) \cup \left(\frac{5}{2},\infty\right)$

8. (5pts) Solve the inequality and write your solution in interval notation.

$-2 \le 3x+1 \le 9$ $\quad |-1$

$-3 \le 3x \le 8$

$-1 \le x \le \frac{8}{3}$

$[-1, \frac{8}{3}]$

9. (10pts) The endpoints of a diameter of a circle are $(-3,4)$ and $(1,2)$.
a) Find the equation of the circle.
b) Draw the circle in the coordinate plane.

center = midpoint of $(-3,4)$ and $(1,2)$

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

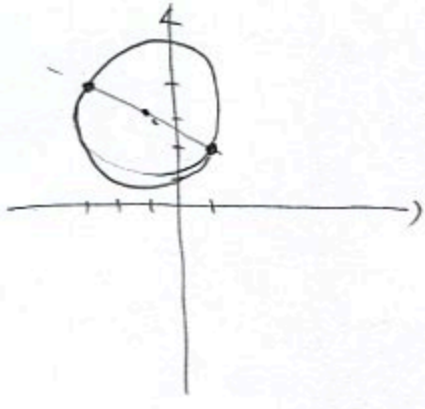
radius = distance from $(1,2)$ to $(-1,3)$

$r = \sqrt{(-1-1)^2+(3-2)^2}$

$= \sqrt{4+1} = \sqrt{5}$

Eq. of circle: $(x-(-1))^2 + (y-3)^2 = \sqrt{5}^2$

$(x+1)^2 + (y-3)^2 = 5$



10. (12pts) Linda has these options for a data plan for her cell phone:
A) \$18 flat fee for the first two GB, and then \$7 per GB for usage beyond the first two GB.
B) \$8 per GB.
Assuming Linda always uses at least 2 GB of data, for which amount of data is plan B better?

x = amount of GB used

A) $18 + 7(x-2)$

B) $8x$

B is better if

$B \le A$

$8x \le 18 + 7(x-2)$

$8x \le 18 + 7x - 14$

$x \le 4$

Plan B is better for usage between 2 and 4 GB.

11. (14pts) Pablo drives to a job interview in an hour and a half. Returning along the same route, he feels more relaxed and drives 11mph slower, so it takes him an hour and three quarters.

a) How fast is Pablo driving on the way to and from the job interview?

b) How far did he travel one-way?

$d, r, 1.5$ →

← $d, r-11, 1.75$

$d = r \cdot 1.5$

$d = (r-11) \cdot 1.75$

$1.5r = 1.75(r-11)$

$1.5r = 1.75r - 19.25$

$19.25 = 0.25r$

$r = 77 \text{ mph}$

a) to interview : 77 mph

From interview : 66 mph

b) $d = 77 \cdot 1.5 = 115.5$ miles

Bonus (10pts) Betty has a total of \$4000 invested in two accounts, one bearing 6% and the other 7% interest. She notices that if she reversed the amounts invested in each account, she would have \$16 more in interest over a year. How much is invested in each account?

x = amt invested at 6% ← $4000-x$ } if reversed

$4000-x$ = ____ 7% ← x }

Interest from investments + 16 = Interest from reversed investments

$0.06x + 0.07(4000-x) + 16 = 0.06(4000-x) + 0.07x$

$0.06x + 280 - 0.07x + 16 = 240 - 0.06x + 0.07x$

$296 - 0.01x = 240 + 0.01x \quad | + 0.01x - 240$

$56 = 0.02x$

$x = \frac{56}{0.02} = 2800$

Betty currently has invested:

\$2800 at 6%

\$1200 at 7%