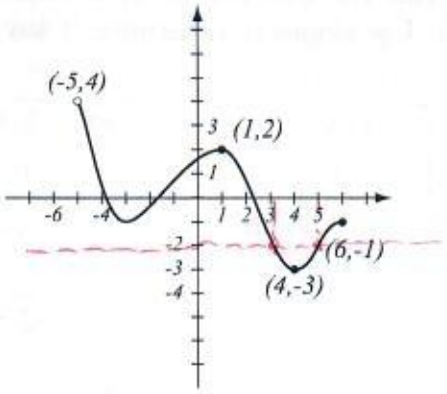
College Algebra — Exam 1
MAT 140C, Spring 2026 — D. Ivanšić

Name: Saul Ocean

Show all your work!

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



a) Find: $f(4) = -3$ $f(1) = 2$

b) What is the domain of f? $(-5, 6]$

c) What is the range of f? $[-3, 4)$

d) What are the solutions of the equation $f(x) = -2$? $x = 3, 5$

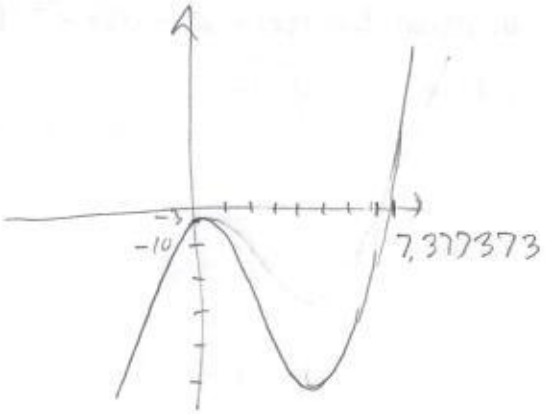
2. (10pts) Use your calculator to accurately sketch the graph of $y = x^3 - 8x^2 + 5x - 3$.

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

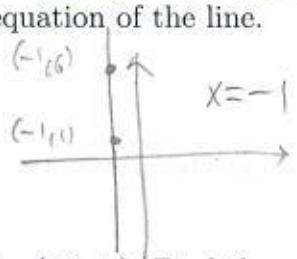
b) Find all the $x-$ and $y-$intercepts (accuracy: 6 decimal points).

y-int: $f(0) = -3$

x-int: 7,377373



3. (5pts) Draw the line that passes through points $(-1, 1)$ and $(-1, 6)$. Then write the equation of the line.



$x = -1$ (vertical line, slope not defined)

4. (10pts) Find the equation of the line (in form $y = mx + b$) that is perpendicular to the line $2x - 4y = 5$ and passes through the point $(4, 1)$. Draw both lines.

$2x - 4y = 5$

$-4y = -2x + 5 \quad | \div(-4)$

$y = \frac{-2x}{-4} + \frac{5}{-4} = \frac{1}{2}x - \frac{5}{4}$

slope $= \frac{1}{2}$

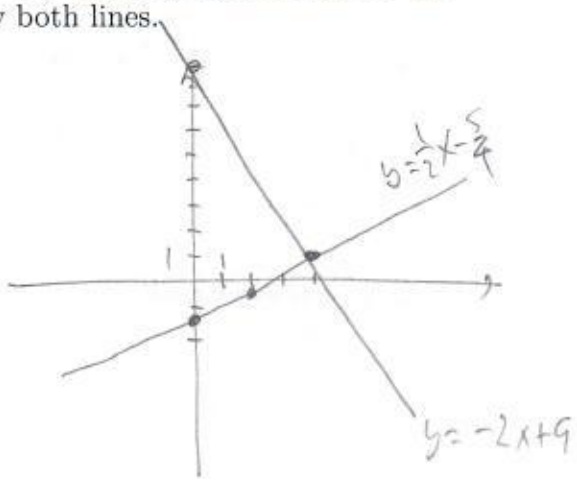
slope of perp. line:

$-\frac{2}{1} = -2$

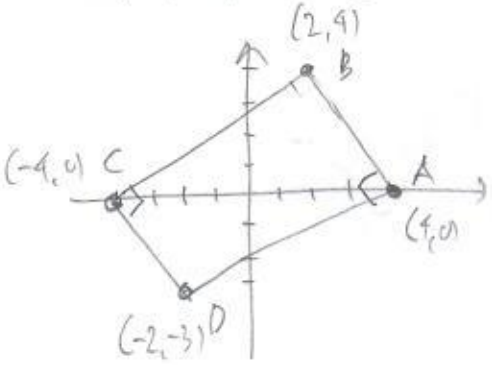
$y - 1 = -2(x - 4)$

$y = -2x + 8 + 1$

$y = -2x + 9$



5. (8pts) Draw the quadrangle with vertices $A = (4,0)$, $B = (2,4)$, $C = (-4,0)$ and $D = (-2,-3)$. Use slopes to determine if any two of its sides are perpendicular.



$m_{AB} = \frac{4-0}{2-4} = \frac{4}{-2} = -2$

$m_{BC} = \frac{0-4}{-4-2} = \frac{-4}{-6} = \frac{2}{3}$

$m_{CD} = \frac{-3-0}{-2-(-4)} = \frac{-3}{2} = -\frac{3}{2}$

$m_{AD} = \frac{-3-0}{-2-4} = \frac{-3}{-6} = \frac{1}{2}$

m_{AB} and m_{AD}; m_{BC} and m_{CD} are opposite reciprocal, so AB is perp. to AD, BC is perp to CD

6. (9pts) Let $f(x) = x^2 - \sqrt{2x-7}$. Find the following (simplify where appropriate).

$f(1) = 1^2 - \sqrt{2\cdot 1 - 7} = 1 - \sqrt{-5}$ not defined

$f(8) = 8^2 - \sqrt{2\cdot 8 - 7} = 64 - \sqrt{9} = 64 - 3 = 61$

$f(4u) = (4u)^2 - \sqrt{2(4u)-7}$

$= 16u^2 - \sqrt{8u-7}$

$f(x+3) = (x+3)^2 - \sqrt{2(x+3)-7}$

$(x+3)(x+3)$

$= x^2 + 3x + 3x + 9 - \sqrt{2x+6-7}$

$= x^2 + 6x + 9 - \sqrt{2x-1}$

7. (9pts) Find the domains of the functions below and write them using interval notation.

$f(x) = \frac{1}{x^2 - 5x - 36}$

Can't have $x^2 - 5x - 36 = 0$

prod $= -36$

sum $= -5$

$(x-9)(x+4) = 0$

$x = 9, -4$

-4 $\quad$ 9

$(-\infty, -4) \cup (-4, 9) \cup (9, \infty)$

$g(x) = \sqrt{2x+7}$

Must have

$2x + 7 \geq 0$

$2x \geq -7$

$x \geq -\frac{7}{2}$

$-\frac{7}{2}$

$\left[-\frac{7}{2}, \infty\right)$

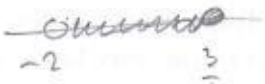
8. (5pts) Solve and write the solution in interval notation.

$4 \leq 7 - 2x < 11$ $|-7$

$-3 \leq -2x < 4$ $|\div -2$

$\frac{-3}{-2} \geqslant x > -2$

$-2 < x \leq \frac{3}{2}$



$(-2, \frac{3}{2}]$

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

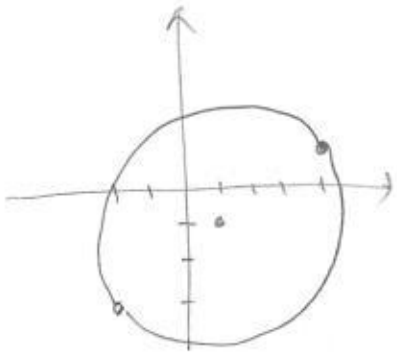
a) Center = midpoint of $(-2,-3), (4,1)$

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

r = distance from $(1,-1)$ to $(4,1)$

$= \sqrt{(1-(-1))^2 + (4-1)^2} = \sqrt{2^2+3^2} = \sqrt{13}$

$(x-1)^2 + (y-(-1))^2 = \sqrt{13}^2$ $(x-1)^2 + (y+1)^2 = 13$



10. (12pts) An electric company offers two plans to pay for electricity usage:
A) \$60 flat fee that includes 200 kWh, then 12 cents per kWh for usage beyond 200 kWh.
B) \$10 flat fee plus 16 cents per kWh.
Assuming a customer always uses at least 200 kWh of electricity, for which amounts of electricity is plan A better?

x = amt of electricity used in kWh

A) cost is $60 + 0.12(x-200)$

B) cost is $10 + 0.16x$

$60 + 0.12(x-200) \leq 10 + 0.16x$

$60 + 0.12x - 24 \leq 10 + 0.16x$ $|-0.12x$

$36 \leq 10 + 0.04x$ $|-10$

$26 \leq 0.04x$

$x \geq \frac{26}{0.04}$

$x \geq 650$

For usage above 650 kWh plan A is better

11. (14pts) Because she was afraid to be late, Fiona rushed to a concert and got there in 2 hours. On the way back, she drove 9mph slower, so it took her a quarter of an hour longer.
a) How fast did Fiona drive to and from the concert?
b) How far did she drive to the concert?

dist rate time

$d, r, 2$ → concert

$d, r-9, 2+\frac{1}{4}$ (2.25)

$d = r \cdot 2$

$d = (r-9) \cdot 2.25$

$2r = 2.25(r-9)$

$2r = 2.25r - 20.25$

$20.25 = 0.25r$

$r = \frac{20.25}{0.25} = 81$ mph

a) drove to concert at 81 mph
returning from concert at 72 mph

b) $d = 81 \cdot 2 = 162$ miles

Bonus (10pts) Madison will invest some money into accounts bearing 2.5% and 3% simple interest. She plans to invest \$600 more into the account bearing 3% interest than the account bearing 2.5% interest. If she wishes to have at least \$106 in total interest after 1 year, what is the least she can invest in the account bearing 2.5% interest? Solve as an inequality.

x amt invested at 2.5%

$x+600$ ——— 3%

interest from 2% + interest from 3% ≥ 106

$x \cdot 0.025 \cdot 1 + (x+600) \cdot 0.03 \cdot 1 \geq 106$

$0.025x + 0.03x + 18 \geq 106$

$0.055x \geq 88$

$x \geq \frac{88}{0.055}$

$x \geq 1600$

Madison needs to invest at least \$1600 to have at least \$106 in interest