College Algebra — Joysheet 9	**Name:** Saul Ocean
MAT 140, Spring 2025 — D. Ivanšić	*Covers: 3.3, 3.4, 3.5 Show all your work!*

1. (4pts) Solve the equation.

$|3x+7|=5$

$3x+7=5$ or $3x+7=-5$

$3x=-2$ $\quad$ $3x=-12$

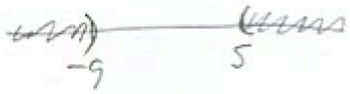
$x=-\frac{2}{3}$ or $x=-4$

2. (12pts) Solve the inequalities. Draw your solution and write it in interval form.

$|x+2|>7$

$x+2>7$ or $x+2<-7$

$x>5$ or $x<-9$



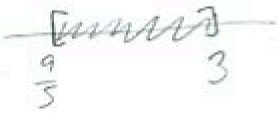
$(-\infty,-9)\cup(5,\infty)$

$|5x-12|\le 3$

$-3\le 5x-12\le 3 \quad |+12$

$9\le 5x\le 15 \quad |\div 5$

$\frac{9}{5}\le x\le 3$



$\left[\frac{9}{5},3\right]$

Solve the equations:

3. (8pts) $\dfrac{x+1}{x-5}+\dfrac{x+2}{x-4}=\dfrac{x^2-4x+1}{x^2-9x+20}$ $\Big|\cdot(x-5)(x-4)$

$(x-5)(x-4)$

$\dfrac{x+1}{\cancel{x-5}}\cancel{(x-5)}(x-4)+\dfrac{x+2}{\cancel{x-4}}(x-5)\cancel{(x-4)}=\dfrac{x^2-4x+1}{\cancel{(x-5)}\cancel{(x-4)}}\cancel{(x-5)}\cancel{(x-4)}$

$(x+1)(x-4)+(x+2)(x-5)=x^2-4x+1$

$x^2-3x-4+x^2-3x-10=x^2-4x+1$

$2x^2-6x-14=x^2-4x+1$

$-x^2+4x-1 \quad -x^2+4x-1$

$x^2-2x-15=0$

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

$x=5$ or -3 $\quad$ 5 gives zero in a denominator

$\boxed{x=-3}$ only solution

4. (8pts) $x+\sqrt{4x-8}=2$

$\sqrt{4x-8}=2-x \quad |^2$

$4x-8=2^2-2\cdot2\cdot x+x^2$

$4x-8=4-4x+x^2 \quad |-4x+8$

$x^2-8x+12=0$

$(x-2)(x-6)=0$

$x=2$ or 6

Check: $2+\sqrt{4\cdot2-8}\overset{?}{=}2$

$2+\sqrt{0}=2$ yes

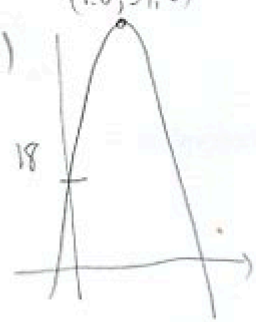
$6+\sqrt{4\cdot6-8}=2$

$6+\sqrt{16}=2$ no

$\boxed{x=2 \text{ only solution}}$

5. (14pts) A ball is thrown upwards from a height of 15 meters with initial velocity 18 meters per second. Its height in meters after t seconds is given by $s(t) = -5t^2 + 18t + 15$.
a) Sketch the graph of the height function.
b) When does the ball reach its greatest height, and what is that height?
c) When does the ball fall to the ground?

a) $(1.8, 31.2)$



Greatest height of 31.2 meters achieved after 1.8 seconds

b) $h = -\frac{b}{2a} = -\frac{18}{2\cdot(-5)} = \frac{18}{10} = \frac{9}{5} = 1.8$

$s(\frac{9}{2}) = -5\cdot(\frac{9}{5})^2 + 18\cdot\frac{9}{5} + 15$

$= -\frac{\cancel{5}\cdot 81}{\cancel{5}\cdot 5} + \frac{162}{5} + 15$

$= \frac{81}{5} + 15 = \frac{81+75}{5}$

$= \frac{156}{5} = 31.2$ meters

c) $-5t^2 + 18t + 15 = 0$

$5t^2 - 18t - 15 = 0$ $324+300$

$t = \frac{-(-18) \pm \sqrt{(-18)^2 - 4\cdot 5\cdot 15}}{2\cdot 5}$

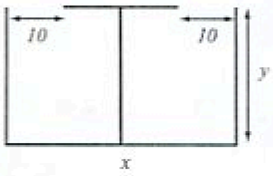
$16\cdot 39$

$= \frac{18 \pm \sqrt{624}}{10} = \frac{18 \pm 4\sqrt{39}}{10}$

$= \frac{2(9 \pm 2\sqrt{39})}{10} = \frac{9 \pm 2\sqrt{39}}{5}$

$9 - 2\sqrt{39} < 0$ so $t = \frac{9 + 2\sqrt{39}}{5} = 4.297999$

6. (14pts) Manuel is planning a building meant to house two stores, each with doors 10 feet wide (see picture). He has budgeted for total wall length 800 feet and his goal is to maximize the enclosed area.
a) Express the area of the building as a function of one of the sides of the rectangle. What is the domain of this function?
c) Sketch the graph of the area function in order to find the maximum (no need for the graphing calculator — you should already know what the graph looks like). What are the dimensions of the building that has the greatest area and what is the greatest area possible?



a) $A = x\cdot y = (410 - \frac{3}{2}y)y = -\frac{3}{2}y^2 + 410y$

$x + x - 20 + 3y = 800$

$2x + 3y = 820$

$2x = 820 - 3y$

$x = 410 - \frac{3}{2}y$

Domain:

must have $y \geq 0$

$x \geq 20$

$410 - \frac{3}{2}y \geq 20$

$\frac{3}{2}y \leq 390$

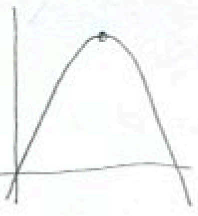
$y \leq 390 \cdot \frac{2}{3}$

$y \leq 260$

Domain for y:

$[0, 260]$

b)



$h = -\frac{b}{2a} = -\frac{410}{2(-\frac{3}{2})} = \frac{410}{3} = 136.6\overline{6}$

$k = -\frac{3}{2}\left(\frac{410}{3}\right)^2 + 410\cdot\frac{410}{3}$

$= -\frac{\cancel{3}}{2}\cdot\frac{410^2}{\cancel{3}\cdot 3} + \frac{410^2}{3} = \frac{410^2}{6}$

$= \frac{84050}{3} = 28016.6\overline{6}$

$410 - \frac{3}{2}\cdot\frac{410}{3} = 205$

Dimensions: 205 by $136.6\overline{6}$

Max area: $28016.6\overline{6}$