College Algebra — Joysheet 9 **MAT 140, Fall 2023 — D. Ivanšić**	**Name:** Saul Ocean *Covers: 3.3, 3.4, 3.5 Show all your work!*

1. (4pts) Solve the equation.

$|3x-5|=4$

$3x-5=4$ or $3x-5=-4$

$3x=9$ $\quad$ $3x=1$

$x=3$ or $x=\frac{1}{3}$

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

$|x-3|\geq 1$

distance from x to $3 \geq 1$

-1 $\quad$ $+1$

2 $\quad$ 3 $\quad$ 4

$(-\infty,2]\cup[4,\infty)$

$|3x+7|<9$

$|3x-(-7)|<9$

distance from $3x$ to $-7<9$

-9 $\quad$ $+9$

-16 $\quad$ -7 $\quad$ $3x$ $\quad$ 2 $\qquad$ $\div 3$

$-\frac{16}{3}$ $\quad$ x $\quad$ $\frac{2}{3}$ $\qquad$ $\left(-\frac{16}{3},\frac{2}{3}\right)$

Solve the equations:

3. (8pts) $\dfrac{2x}{x-3}=\dfrac{x+5}{x-2}+\dfrac{18-4x}{x^2-5x+6}$ $\Big|\cdot(x-2)(x-3)$

$(x-2)(x-3)$

$\frac{2x}{\cancel{x-3}}\cdot(x-2)\cancel{(x-3)}=\frac{x+5}{\cancel{x-2}}\cancel{(x-2)}(x-3)+\frac{18-4x}{\cancel{(x-2)}\cancel{(x-3)}}\cancel{(x-2)}\cancel{(x-3)}$

$2x(x-2)=(x+5)(x-3)+18-4x$

$2x^2-4x=x^2+2x-15+18-4x$

$2x^2-4x=x^2-2x+3 \quad \big|-x^2+2x-3$

$x^2-2x-3=0$ $\qquad$ $x=3$ or -1

$(x-3)(x+1)=0$ $\qquad$ 3 gives 0 in denom,

only $x=-1$ is the solution

4. (8pts) $4=x+\sqrt{52-3x}$

$4-x=\sqrt{52-3x} \quad \big|^2$

$(4-x)^2=52-3x$

$4^2-2\cdot4\cdot x+x^2=52-3x \quad \big|+3x-52$

$x^2-5x-36=0$

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

$x=9,-4$

Check: $4=9+\sqrt{52-27}$

$4=9+\sqrt{25}$ no

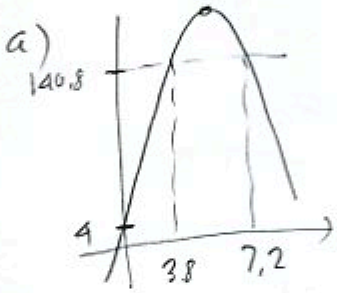
$4=-4+\sqrt{52+12}$

$4=-4+\sqrt{64}$ yes

Only $x=-4$ is the solution

5. (14pts) An arrow is launched from height 4 meters upwards with initial velocity 55 meters per second. Its height in meters after t seconds is given by $s(t) = -5t^2 + 55t + 4$.
a) Sketch the graph of the height function.
b) When does the arrow reach its greatest height, and what is that height?
c) When is the arrow at height 140.8 meters?

a)



b) Need vertex

$x = -\frac{b}{2a} = -\frac{55}{2\cdot(-5)} = 5.5$ sec

$s(5.5) = -5\cdot 5.5^2 + 55\cdot 5.5 + 4 = 155.25$ m

max height of 155.25 meters reached after 5.5 seconds

c) $s(t) = 140.8$

$-5t^2 + 55t + 4 = 140.8$

$-5t^2 + 55t - 136.8 = 0$

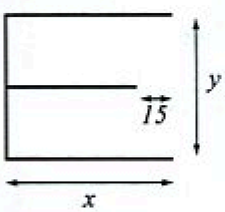
$5t^2 - 55t + 136.8 = 0$

$3025 - 2736$

$t = \frac{-(-55) \pm \sqrt{(-55)^2 - 4\cdot 5\cdot 136.8}}{2\cdot 5} = \frac{55 \pm \sqrt{289}}{10} = \frac{55 \pm 17}{10}$

$= \frac{72}{10}, \frac{38}{10} = 7.2, 3.8$ seconds

6. (14pts) Truck mechanic Grayson wishes to build a repair shop with two side-by-side bays separated by a shorter wall (see picture). Grayson has enough money to build 1500 feet of walls, and he wants to build a shop with maximal area.
a) Express the total area of the shop as a function of one of the sides of the rectangle. What is the domain of this function?
b) 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 shop that has the greatest total area? What is the greatest area possible?



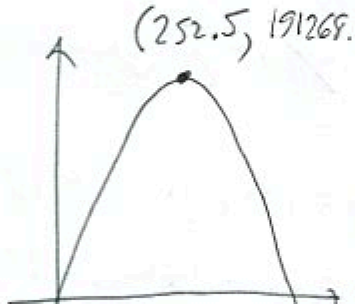
a) $A = xy = x(1515 - 3x) = -3x^2 + 1515x = A(x)$

$x + x - 15 + x + y = 1500$

$3x + y = 1515$

$y = 1515 - 3x$

b)



Domain: Must have:

$x \geq 15$

$y \geq 0$

$1515 - 3x \geq 0$

$3x \leq 1515$

$x \leq 505$

Domain: $[15, 505]$

$-\frac{b}{2a} = -\frac{1515}{2\cdot(-3)} = 252.5$

Dimensions are 252.5×757.5 ft

$1515 - 3\cdot 252.5$

Max area is 191268.75 ft^2