

N1 Homework

1) Lydia - not a function
 Eugene - Surjective
 Rick - Injective

2) $y = x^2 + 1$;
 if $x = 1$;
 $y = x^2 + 1$;
 $y = 1 + 1$;
 $y = 2$;
 $y = x^2 + 1$ - function;

$y^2 = x + 1$;
 if $x = 3$;
 $y^2 = 4$
 $y_1 = 2$ $y_2 = -2$
 $y^2 = x + 1$ is not a function;

3) H - is surjective, no missing codomains.

4) f, h - injective functions;

5) $f(x) = \frac{1}{x+2}$;
 ~~$f(x)^{-1} = \frac{1}{x+2}$~~
 ~~$f(x)^{-1} = x+2$~~
 $g(x) = \frac{1}{x} - 2$;
 $g(f(x)) = \frac{1}{(\frac{1}{x+2})} - 2$;
 $g(f(x)) = x$;
 $g = f^{-1}$

$f(g(x)) = \frac{1}{\frac{1}{x} - 2 + 2}$;
 $f(g(x)) = \frac{1}{\frac{1}{x}}$;
 $f(g(x)) = x$;
 $f = g^{-1}$

6) $f(x) = 2 + \sqrt{x-4}$;
 $y = 2 + \sqrt{x-4}$;
 $(y-2)^2 = x-4$;
 $x = (y-2)^2 + 4$;
 $f^{-1}(x) = (x-2)^2 + 4$;

$$C = \frac{5}{9} (F - 32);$$

$$\frac{9}{5} C = \frac{5}{9} \cdot \frac{9}{5} (F - 32);$$

$$\frac{9}{5} C = F - 32;$$

$$-F = -32 - \frac{9}{5} C;$$

$$F = 32 + \frac{9}{5} C = f^{-1}(C)$$

$$8) g(x) = 2\sqrt{x-4};$$

$$x-4 \geq 0;$$

$$x \geq 4;$$

$$D \in \text{[crossed out]} [4; \infty);$$

$$R \in [0; \infty);$$

$$g(4) = 2\sqrt{4-4};$$

$$g(4) = 2\sqrt{0};$$

$$g(4) = 0;$$

$$g(5) = 2\sqrt{5-4};$$

$$g(5) = 2\sqrt{1};$$

$$g(5) = 2;$$

$$g(8) = 2\sqrt{8-4};$$

$$g(8) = 4;$$

$$9) h(x) = -2x^2 + 4x - 9;$$

$$x \in (-\infty; \infty)$$

$$\text{Vertex} = -\frac{b}{2a};$$

$$x = \frac{-4}{-2 \cdot 2} = 1;$$

$$h(1) = -2 + 4 - 9 = -7;$$

$$y \in (1; -7);$$

$$h(x) \in (-\infty; -7] \text{ [crossed out]}$$

$$10) f(x) = \frac{x-4}{x^2-2x-15};$$

$$x^2-2x-15 \neq 0;$$

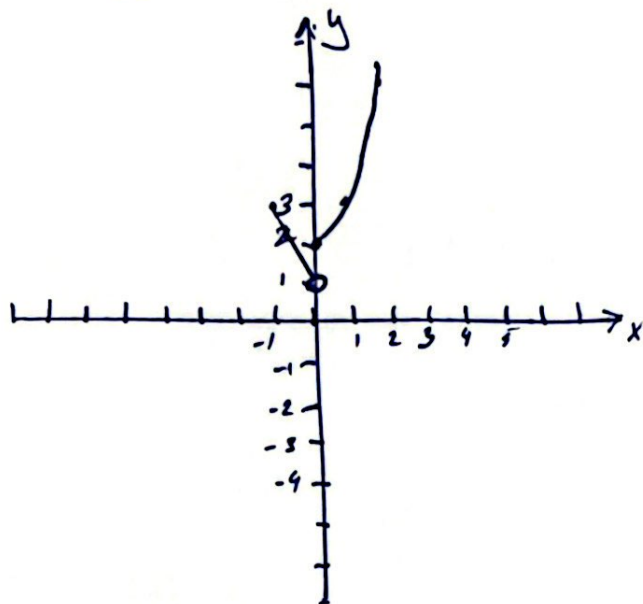
$$(x-5)(x+3) \neq 0$$

$$x \neq 5; x \neq -3$$

$$D = (-\infty; -3) \cup (-3; 5) \cup (5; \infty)$$

11)

$$f(x) = \begin{cases} -2x + 1 & -1 \leq x < 0 \\ x^2 + 2 & 0 \leq x \leq 2 \end{cases}$$



1) $f(-1) = -2(-1) + 1$
 $f(-1) = 3$
 $f(0) = 1$

2) $f(0) = 2$
 $f(1) = 3$
 $f(2) = 6$

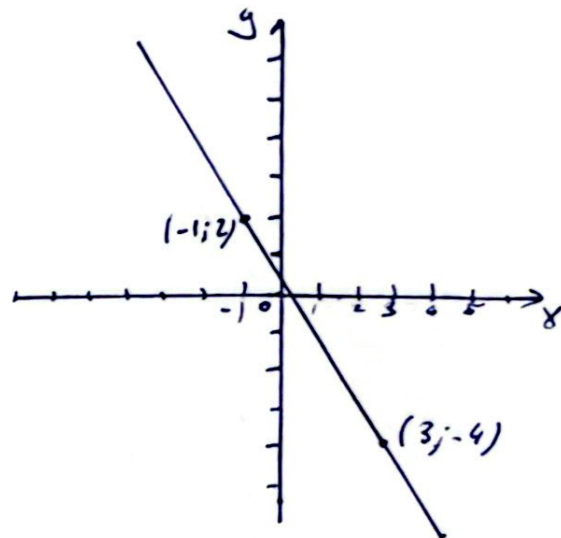
Don't intersect;
 \emptyset

12) $x_1 = -1; y_1 = 2; \quad x_2 = 3; y_2 = -4$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{-4 - 2}{3 - (-1)}$$

$$m = -\frac{3}{2}$$



13) $x_1 = 1; y_1 = -1; \quad m = \frac{3}{4}$

$$y = mx + b$$

$$\frac{3}{4} + b = -1$$

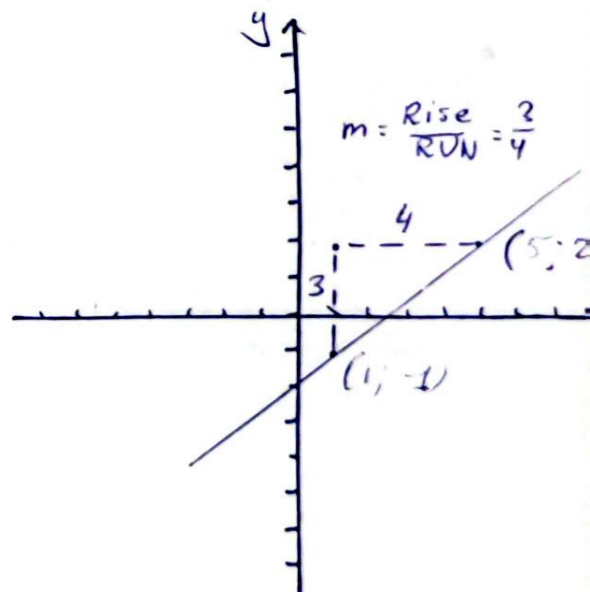
$$b = -1\frac{3}{4}$$

$$\frac{3}{4}x - 1\frac{3}{4} = y$$

$$\text{if } x = 5$$

$$\frac{15}{4} - 1\frac{3}{4} = y$$

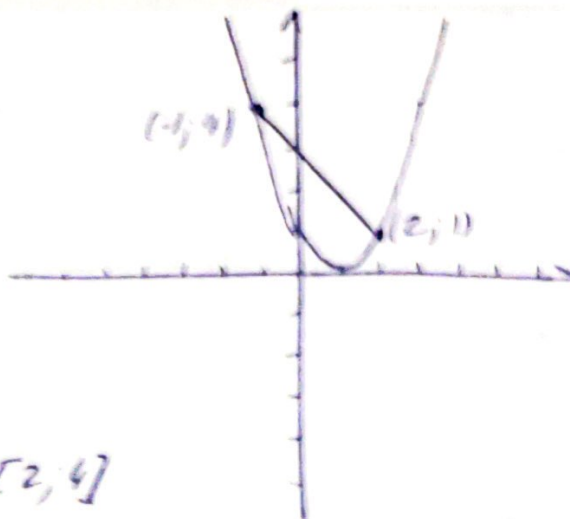
$$2 = y$$



$$g(-1) = 4;$$

$$g(2) = 1;$$

$$m = \frac{1-4}{2-(-1)} = -3$$



$$1) f(x) = x^2 - \frac{1}{x}; \text{ interval } [2, 4]$$

$$f(2) = 4 - \frac{1}{2}$$

$$f(2) = 3.5;$$

$$f(4) = 16 - \frac{1}{4};$$

$$f(4) = 15\frac{3}{4};$$

AVERAGE RATE of change

$$\frac{\frac{63}{4} - \frac{14}{4}}{4-2} = \frac{49}{8}$$

$$16) f(t) = t^2 - t; h(x) = 3x + 2;$$

$$h(1) = 3 \cdot 1 + 2;$$

$$h(1) = 5;$$

$$f(h(1)) = f(5)$$

$$f(5) = 25 - 5;$$

$$f(5) = 20;$$

$$17) f(x) = \frac{5}{x-1};$$

$$x-1 \neq 0;$$

$$x \neq 1;$$

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

$$3x-2 \neq 0;$$

$$3x \neq 2;$$

$$x \neq \frac{2}{3};$$

$$g(x) = \frac{4}{3x-2} \neq 1$$

$$4 = 3x-2$$

$$6 = 3x$$

$$x = 2$$

$$(-\infty, \frac{2}{3}) \cup (\frac{2}{3}, 2) \cup (2, \infty)$$

$$D(f \circ g) = (-\infty, 0) \cup (0, \frac{2}{3}) \cup (\frac{2}{3}, \infty);$$

$$f(g(x)) =$$

$$18) (g-f)(x) = ? \quad f(x) = x-1; \quad g(x) = x^2-1;$$

$$\left(\frac{g}{f}\right)(x) = ? \quad (g-f)(x) = g(x) - f(x);$$

$$g(x) - f(x) = x^2 - 1 - x + 1;$$

$$(g-f)(x) = x^2 - x;$$

$$\left(\frac{g}{f}\right)(x) = \frac{x^2 - x}{x - 1};$$

$$\left(\frac{g}{f}\right)(x) = \frac{(x+1)(x-1)}{\cancel{x-1}};$$

$$\left(\frac{g}{f}\right)(x) = x+1$$

$$19) (5; 1) \quad y - y_1 = m(x - x_1)$$

$$(8; 7)$$

$$m = \frac{7-1}{8-5} = 2$$

$$y - 1 = 2(x - 5);$$

$$y = 2x - 10 + 1$$

$$y = 2x - 9$$

$$20) f(x) = (3; -2) (8; 1)$$

Increasing

$$m = \frac{1 - (-2)}{8 - 3};$$

$$m = \frac{3}{5};$$

21) —

$$22) 2x + 3 \text{ and } 2x - 6 \text{ are } \parallel$$

$$-2x + 2 \text{ and } \frac{1}{2}x - 4 \text{ are } \perp$$

$$23) \begin{cases} 2x + y = 7; \\ x - 2y = 6; \end{cases} \Rightarrow y = 7 - 2x$$

$$x - 2(7 - 2x) = 6 \Rightarrow y = 7 - 2 \cdot (4)$$

$$x - 14 + 4x = 6$$

$$5x = 20$$

$$x = 4;$$

$$(4; -1)$$

$$24) \begin{cases} 4x + 2y = 4 \\ 6x - y = 8 \end{cases}$$

$$2y = 4 - 4x;$$

$$y = 2 - 2x$$

$$\left(\frac{5}{4}; -\frac{1}{2}\right)$$

$$6x - 2 + 2x = 8$$

$$8x = 10$$

$$x = \frac{5}{4}$$

$$5 + 2y = 4$$

$$2y = -1$$

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

$$25) f(x) = a(x-h)^2 + k$$

$$\text{Vertex}(h, k) \quad h = -\frac{b}{2a}; \quad k = f(h) = f\left(-\frac{b}{2a}\right)$$

$$f(x) = 2x^2 - 6x + 7$$

$$h = -\frac{(-6)}{2 \cdot (2)}; \quad k = 2\left(\frac{3}{2}\right)^2 - 6\left(\frac{3}{2}\right) + 7$$

$$h = +1.5 = \left(\frac{3}{2}\right)$$

~~$$k = 2 \cdot \frac{9}{4} - 6 \cdot \frac{3}{2} + 7 = \frac{18}{4} - 9 + 7 = \frac{18}{4} - 2 = \frac{5}{2}$$~~

$$k = \frac{2 \cdot 9}{4} - \frac{6 \cdot 3}{2} + 7;$$

$$k = \frac{18}{4} - 9 + 7 = \frac{18}{4} - 2 = \left(\frac{5}{2}\right)$$

$$\left(\frac{3}{2}; \frac{5}{2}\right)$$

$$f(x) = 2\left(x - \frac{3}{2}\right)^2 + \frac{5}{2};$$

$$26) f(x) = -5x^2 + 3x - 1;$$

$$D(-\infty; \infty);$$

$$h = -\frac{b}{2a}$$

$$h = -\frac{3}{2 \cdot (-5)} = \frac{3}{10}$$

$$f\left(\frac{3}{10}\right) = -5\left(\frac{3}{10}\right)^2 + \frac{9}{10} - 1$$

$$f\left(\frac{3}{10}\right) = -5 \frac{81}{100} + \frac{71}{10};$$

$$f\left(\frac{3}{10}\right) = \frac{-405 + 710}{100} = \frac{305}{100} = \frac{61}{20} \quad \text{Range } (-\infty; \frac{61}{20}]$$

$$7) f(x) = 3x^2 + 5x - 2;$$

$$f(0) = -2$$

$$3x^2 + 5x - 2 = 0$$

$$(3x-1)(x+2) = 0$$

$$3x-1 \neq 0 \quad x = -2$$

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

y-intercept $(0; -2)$

x-intercept $(\frac{1}{3}; 0) \quad (-2; 0)$

$$28) -1 \leq 2x - 5 < 7$$

$$4 \leq 2x < 12$$

$$2 \leq x < 6$$

$$[2; 6)$$

$$x^2 + 7x + 10 < 0$$

$$(x+5)(x+2) < 0$$

$$x > -5 \vee x < -2$$

$$(-5; -2)$$

$$-15 < 2x - 5 < 7$$

$$-6 < x - 2 < 4$$

$$-4 < x < 6$$

$$(-4; 6)$$

$$29) 10 - (2y + 1) \leq -4(3y + 2) - 3$$

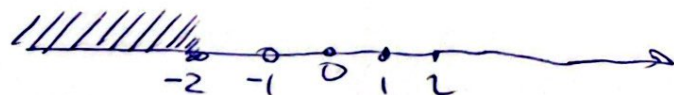
$$10 - 2y - 1 \leq -12y - 8 - 3$$

$$9 - 2y \leq -12y - 11$$

$$10y \leq -20$$

$$y \leq -2$$

$$(-\infty; -2]$$



$$30) x(x+3)^2(x-4) \leq 0$$

$$x \neq 0$$

$$x \neq 4$$

$$x \neq -3$$

$$x \in (0; 4)$$



$$31) 2x^4 > 3x^3 + 9x^2;$$

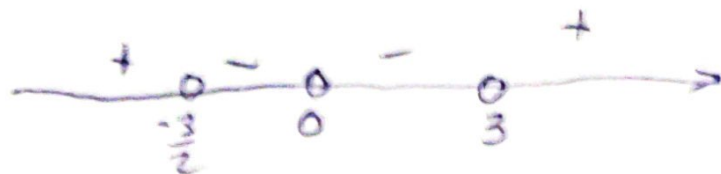
$$2x^4 - 3x^3 - 9x^2 > 0;$$

$$x^2(2x^2 - 3x - 9) = 0;$$

$$x^2(2x+3)(x-3) = 0;$$

$$x \neq 0; x = -\frac{3}{2}; x \neq 3$$

$$(-\infty; -\frac{3}{2}) \cup (3; \infty)$$



$$32) f(x) = -\frac{1}{2}|4x-5| + 3;$$

$$-\frac{1}{2}|4x-5| + 3 < 0;$$

$$-\frac{1}{2}|4x-5| < -3$$

$$|4x-5| > 6$$

$$4x-5 = 6 \quad 4x-5 = -6$$

$$4x = 11$$

$$4x = -1$$

$$x = \frac{11}{4}$$

$$x = -\frac{1}{4}$$

$$(-\infty; -\frac{1}{4}) \cup (\frac{11}{4}; \infty)$$

$$33) 13 - 2|4x-7| \leq 3$$

$$-2|4x-7| \leq -10$$

$$|4x-7| \geq 5$$

$$4x-7 \leq -5$$

$$4x-7 \geq 5$$

$$x \leq \frac{1}{2}$$

$$x \geq 3$$

$$(-\infty; \frac{1}{2}] \cup [3; \infty)$$