WRH6 Solutions

3.1: 1, 8, 17, 27, 34, 38, 43, 50, 65, 69, 80, 83, 88
3.2: 1, 13, 17, 21, 24
3.3: 3, 18, 21

3.1

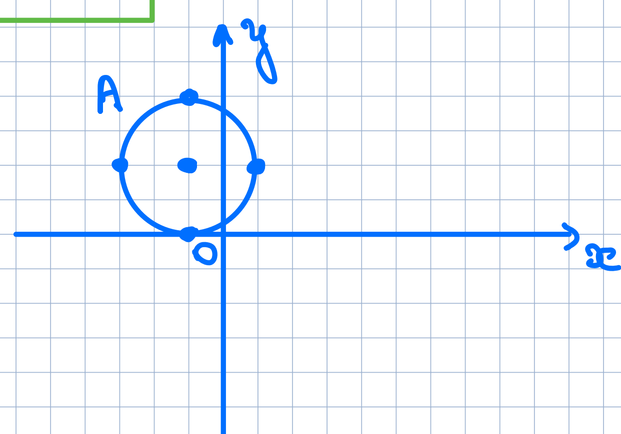
1. $R = \{(-2,5), (-2,3), (-2,0), (-2,-9)\}$

$$\boxed{\begin{aligned} \text{Dom}(R) &= \{-2\} \\ \text{Ran}(R) &= \{5, 3, 0, -9\} \end{aligned}}$$

8. $D = \{(5x, 3y) \mid x \in \mathbb{Z} \text{ and } y \in \mathbb{Z}\}$

$$\boxed{\begin{aligned} \text{dom}(D) &= \{5x \mid x \in \mathbb{Z}\} \\ \text{Ran}(D) &= \{3y \mid y \in \mathbb{Z}\} \end{aligned}}$$

17.

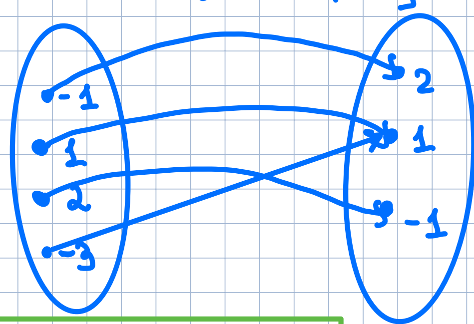


$$\boxed{\begin{aligned} \text{Dom}(A) &= [-3, 1] \\ \text{Ran}(A) &= [0, 4] \end{aligned}}$$

27. $T = \{(-1,2),(1,1),(2,-1),(-3,1)\}$

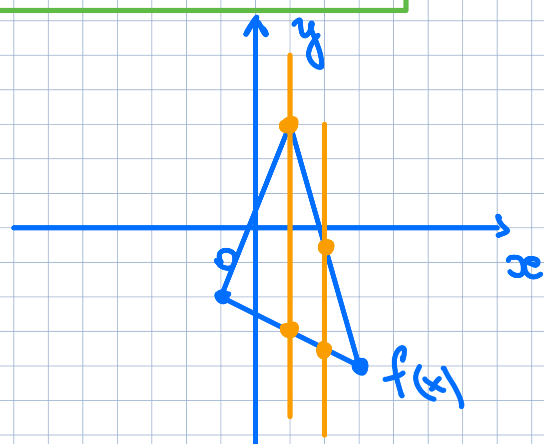
$Dom(T) = \{-1, 1, 2, -3\}$

$Ran(T) = \{2, 1, -1\}$



T is a function.

34.



f(x) is not a function.
For instance, we can consider points (1,3) and (1,-3).

38. $x = y^2 - 1$

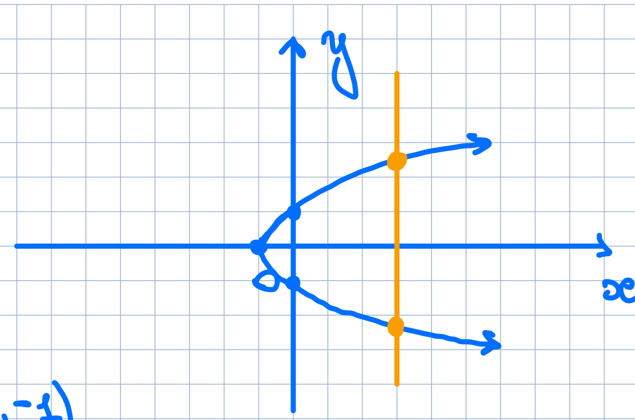
Not a function

For $x=0$ we have

$y^2 = 1$

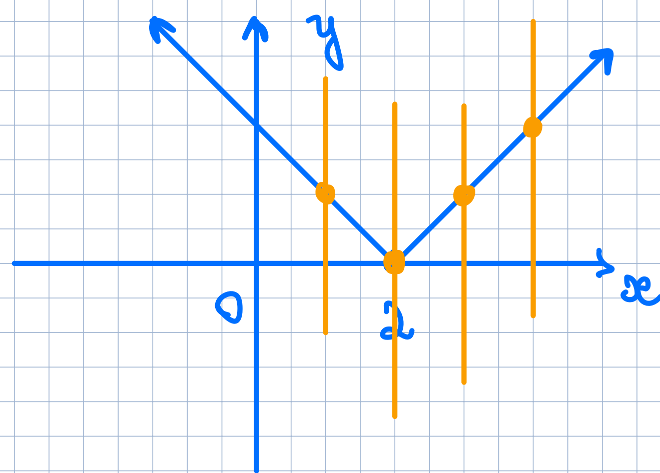
$y = \pm 1$

$(0,1)$ and $(0,-1)$



43. $y = |x-2|$

$\boxed{y \text{ is a function}}$



50. $x^2 + y = 3 - 4x^2 + 2y$

$y = x^2 - 3 + 4x^2$

$\boxed{y = 5x^2 - 3}$

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

$\boxed{y(-1) = 2.}$

65. $f(x) = \sqrt{1-x} - 3$

(a) $f(2) = \sqrt{1-2} - 3 = \sqrt{-1} - 3 = \boxed{i - 3}$

(b) $f(x-1) = \sqrt{1-(x-1)} - 3 = \sqrt{1-x+1} - 3 =$

$= \boxed{\sqrt{2-x} - 3}$

(c) $f(x+a) - f(x) = \sqrt{1-x-a} - \cancel{3} - \sqrt{1-x} + \cancel{3} =$

$= \boxed{\sqrt{1-x-a} - \sqrt{1-x}}$

(d) $f(x^2) = \boxed{\sqrt{1-x^2} - 3}$

69. $f(x) = \dfrac{1}{x+2}$

$$\frac{f(x+h) - f(x)}{h} = \frac{\dfrac{1}{x+2+h} - \dfrac{1}{x+2}}{h} =$$

$$= \frac{(x+2) - (x+2+h)}{h(x+2+h)(x+2)} = \frac{\cancel{x}+\cancel{2}-\cancel{x}-\cancel{2}-h}{h(x+2+h)(x+2)} =$$

$$= \frac{-h}{h(x+2+h)(x+2)} = \boxed{\frac{-1}{(x+2+h)(x+2)}}$$

80. $g: [0,\infty) \to \mathbb{R}$

$g(x) = \sqrt{x}$

$$\boxed{\begin{aligned} &\text{Dom}(g) = [0,\infty) \\ &\text{Codomain}(g) = \mathbb{R} \\ &\text{Ran}(g) = [0,\infty) \end{aligned}}$$

83. $f(x) = \sqrt{x-1}$

Dom:

$$x - 1 \geq 0$$

$$x \geq 1$$

$$x \in [1,\infty)$$

$$\boxed{\text{Dom}(f) = [1,\infty)}$$

88. $h(x) = \dfrac{3x^2-6x}{x^2-6x+9}$

Domain of $h(x)$ is all real numbers except of x values at which

$$x^2 - 6x + 9 = 0.$$

Therefore, we set

$$x^2 - 6x + 9 \neq 0$$

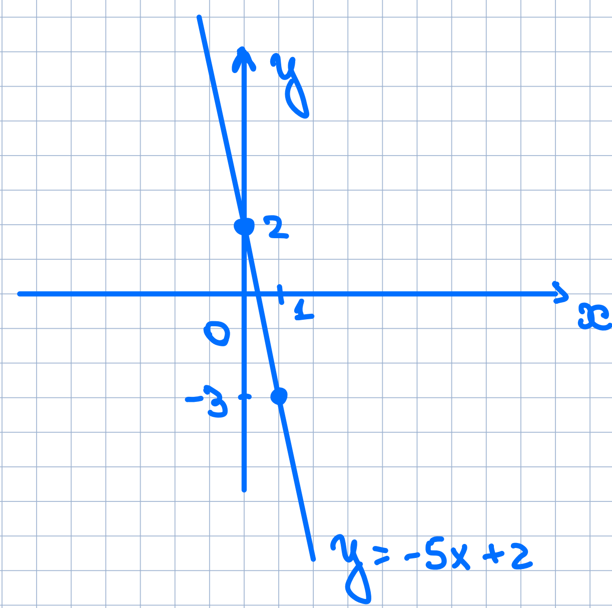
$$(x-3)(x-3) \neq 0$$

$$x \neq 3$$

$$\boxed{\text{Dom}(h) = (-\infty,3)\cup(3,+\infty).}$$

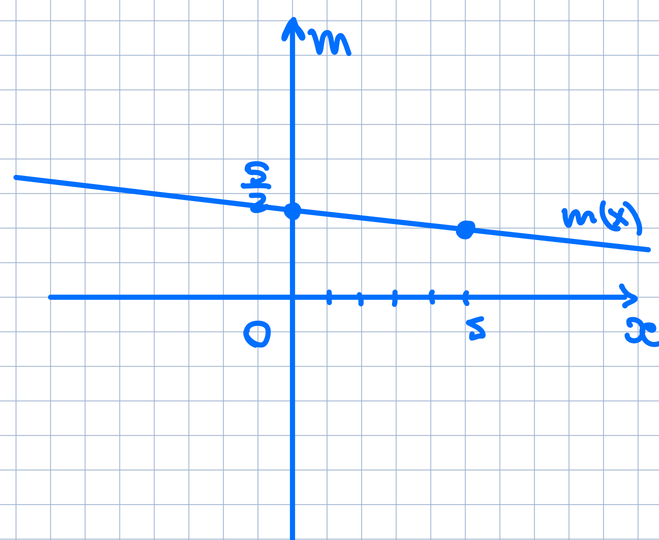
3.2

1. $f(x) = -5x+2$



13. $m(x) = \frac{-x+25}{10}$

$m(x) = -\frac{x}{10} + \frac{5}{2}$



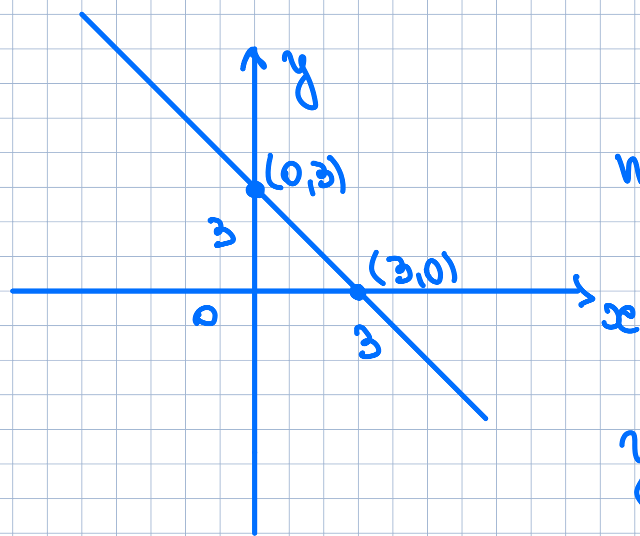
17. $f(x) = 3x - \frac{7+8x}{3}$

$f(x) = 3x - \frac{7}{3} - \frac{8x}{3} = \frac{x}{3} - \frac{7}{3}$

$m = \frac{1}{3}$ $\quad (0,b) = (0, -\frac{7}{3})$

$\boxed{(b)}$

21.



$$m = \frac{0-3}{3-0} = -1$$

$$y = -1 \cdot x + b$$

$$(0,b) = (0,3)$$

Therefore, $\boxed{y = -x + 3}$

24.

$$(0,3),\ (1,5),\ (2,7),\ (3,8),\ (5,9),\ (6,9)$$

(a)

$$\bar{x} = \frac{0+1+2+3+5+6}{6} = \frac{17}{6}$$

$$\bar{y} = \frac{3+5+7+8+9+9}{6} = \frac{41}{6}$$

$$\Delta x = x - \bar{x}$$

$$\Delta y = y - \bar{y}$$

Δx	Δy	$(\Delta x)^2$	$(\Delta y)^2$	$\Delta x \Delta y$
$-\frac{17}{6}$	$-\frac{23}{6}$	$\frac{289}{36}$	$\frac{529}{36}$	$\frac{391}{36}$
$-\frac{11}{6}$	$-\frac{11}{6}$	$\frac{121}{36}$	$\frac{121}{36}$	$\frac{121}{36}$
$-\frac{5}{6}$	$\frac{1}{6}$	$\frac{25}{36}$	$\frac{1}{36}$	$-\frac{5}{36}$
$\frac{1}{6}$	$\frac{7}{6}$	$\frac{1}{36}$	$\frac{49}{36}$	$\frac{7}{36}$
$\frac{13}{6}$	$\frac{13}{6}$	$\frac{169}{36}$	$\frac{169}{36}$	$\frac{169}{36}$
$\frac{19}{6}$	$\frac{13}{6}$	$\frac{361}{36}$	$\frac{169}{36}$	$\frac{247}{36}$

$$m = \frac{\sum \Delta x \Delta y}{\sum (\Delta x)^2}$$

$$\sum \Delta x \Delta y = \frac{930}{36} = \frac{155}{6}$$

$$\sum (\Delta x)^2 = \frac{966}{36} = \frac{161}{6}$$

$$m = \frac{155 \cdot 6}{6 \cdot 161} = \frac{155}{161}$$

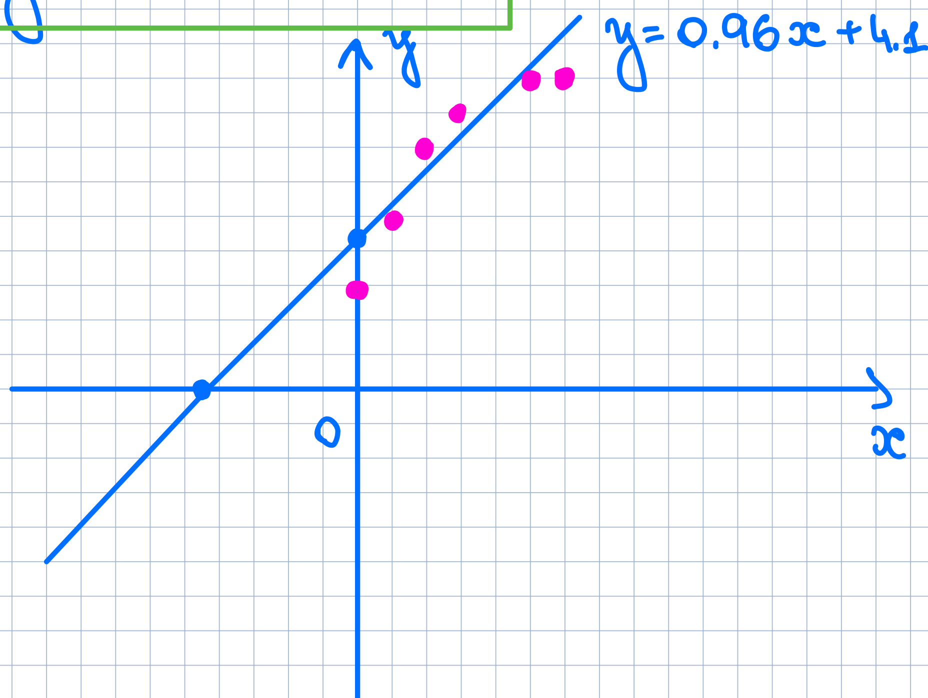
$$b = \bar{y} - m \cdot \bar{x} = \frac{41}{6} - \frac{155}{161} \cdot \frac{17}{6}$$

$$b = \frac{6601 - 2635}{161 \cdot 6} = \frac{3966}{161 \cdot 6} = \frac{661}{161}$$

Therefore,

$$y = \frac{155}{161} x + \frac{661}{161}$$

$$\boxed{y = 0.96x + 4.1}$$



(b)

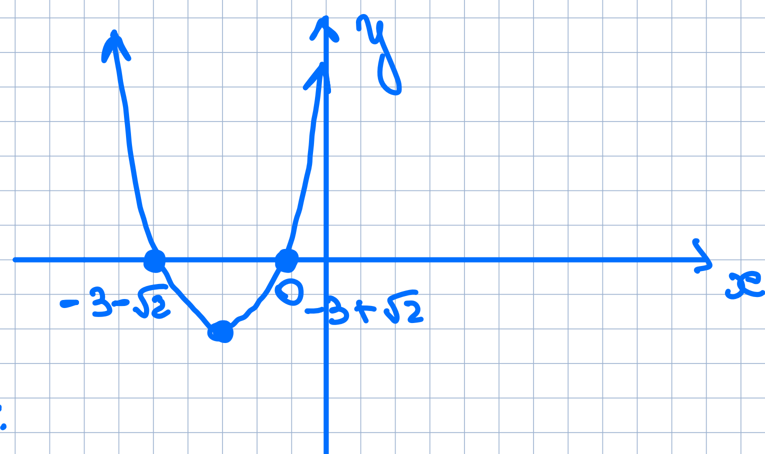
$$r = \frac{\sum \Delta x \Delta y}{\sqrt{\sum (\Delta x)^2} \sqrt{\sum (\Delta y)^2}} = \frac{\frac{155}{6}}{\sqrt{\frac{161}{6}} \cdot \sqrt{\frac{173}{6}}}$$

$$\sum (\Delta y)^2 = \frac{173}{6}$$

$$\boxed{r = 0.929}$$

$\boxed{3.3}$

3. $h(x) = x^2 + 6x + 7$



peak vertex:

$$\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right) = \left(-\frac{6}{2}, f(-3)\right) =$$

$$= (-3, 9-18+7) = \boxed{(-3, -2)}$$

$D = 36 - 28 = 8$

$$x_1 = \frac{-6+2\sqrt{2}}{2} = \boxed{-3+\sqrt{2}}$$
$$x_2 = \frac{-6-2\sqrt{2}}{2} = \boxed{-3-\sqrt{2}}$$

$\left.\begin{matrix}(-3+\sqrt{2},0)\\(-3-\sqrt{2},0)\end{matrix}\right\}$

x-intercept

18. $f(x) = \dfrac{x^2-8x+16}{2} = \dfrac{1}{2}x^2 - 4x + 8$

$D = 16 - 4 \cdot \frac{1}{2} \cdot 8 = 16 - 16 = 0$

$x_{1,2} = \dfrac{4 \pm 0}{2\frac{1}{2}} = 4$

$\boxed{(a)}$

21.

(a) $y = ax^2 + bx + c$

x-intercept: $(-2,0)$ and $(1,0)$

$y = a(x+2)(x-1)$

$A(0,1)$ belongs to the graph.

Hence,

A: $1 = -2a \Rightarrow a = -\frac{1}{2}$

Therefore, $\boxed{y = -\frac{1}{2}(x+2)(x-1)}$

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

peak vertex: $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$

$$-\frac{b}{2a} = \frac{\frac{1}{2}}{2\cdot\left(-\frac{1}{2}\right)} = -\frac{1}{2}$$

$$f\left(-\frac{1}{2}\right) = \frac{9}{8}$$

Hence, we get $\boxed{\left(-\frac{1}{2}, \frac{9}{8}\right)}$.