

Name: _____
PC: Algebraic Definition of Absolute Value

Date: _____
Ms. Loughran

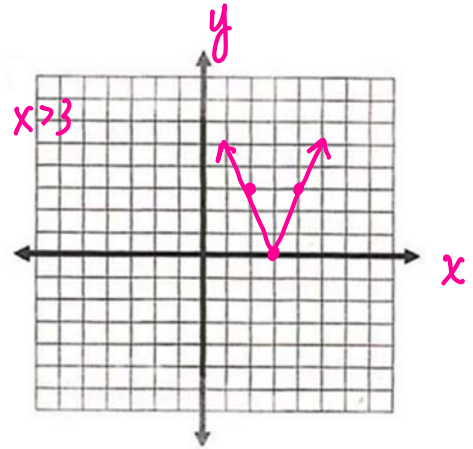
Do Now:

Use the algebraic definition of absolute value to write each of the following as piecewise functions. Then graph them and find the domain and range of each.

1. $|9-3x| = |3x-9|$

$$|3x-9| = \begin{cases} 3x-9 & \text{if } 3x-9 \geq 0, x \geq 3 \\ -3x+9 & \text{if } x < 3 \end{cases}$$

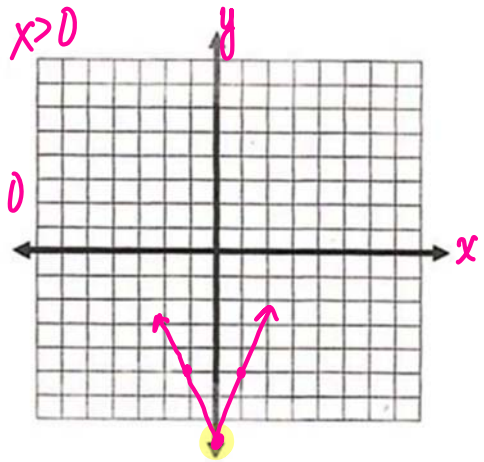
$$D: (-\infty, \infty)$$
$$R: [0, \infty)$$



2. $3|x|-9$

$$3|x|-9 = \begin{cases} 3x-9 & \text{if } x \geq 0 \text{ or } x > 0 \\ -3x-9 & \text{if } x < 0 \text{ or } x \leq 0 \end{cases}$$

$$D: (-\infty, \infty)$$
$$R: [-9, \infty)$$

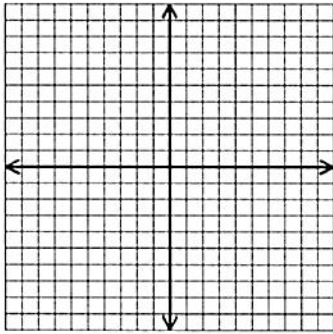


Name: _____
PC: Transformations of Functions

Date: _____
Ms. Loughran

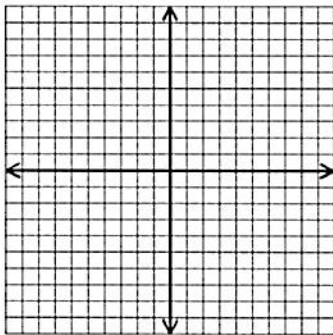
Do Now Activity

1. Graph $y = x^2$.



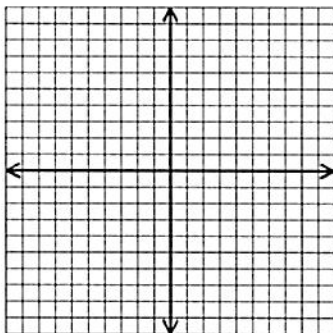
2. Graph $y = (x + 4)^2$ and describe how it is related to $y = x^2$.

moves it left 4



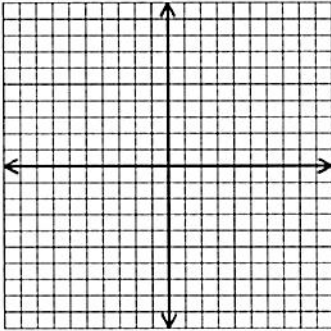
3. Graph $y = (x - 2)^2$ and describe how it is related to $y = x^2$.

moves it right 2



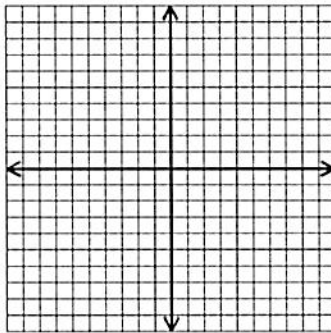
4. Graph $y = x^2 + 4$ and describe how it is related to $y = x^2$.

moves it up 4



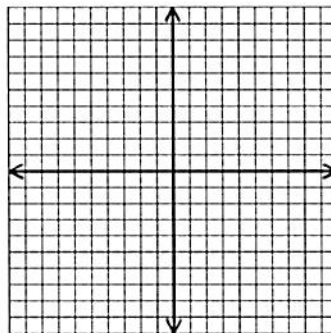
5. Graph $y = x^2 - 2$ and describe how it is related to $y = x^2$.

moves it down 2

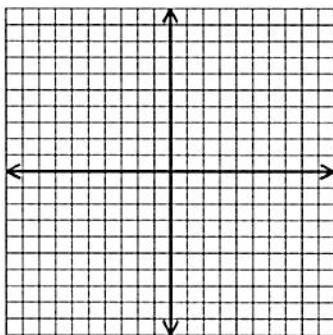


6. Graph $y = -x^2$ and describe how it is related to $y = x^2$.

reflects it over the x-axis



7. Graph $y = (-x)^2$ and describe how it is related to $y = x^2$.



reflects it over the y-axis

Use what you have discovered in questions 1 – 7 to fill in the following blanks:

- $f(x) + a$ is $f(x)$ shifted up a units
- $f(x) - a$ is $f(x)$ shifted down a units
- $f(x + a)$ is $f(x)$ shifted left a units
- $f(x - a)$ is $f(x)$ shifted right a units
- $-f(x)$ is $f(x)$ reflected over the x-axis
(negate the y-values)
- $f(-x)$ is $f(x)$ reflected over the y-axis
(negate the x-values)

Parent Functions

minimum of 3

Function	Domain and Range	Key Points	Graph
Quadratic Equation: <u>$f(x) = x^2$</u>	$D: (-\infty, \infty)$ $R: [0, \infty)$	$(-2, 4)$ $(-1, 1)$ $(0, 0)$ $(1, 1)$ $(2, 4)$	
Cubic Equation: <u>$f(x) = x^3$</u>	$D: (-\infty, \infty)$ $R: (-\infty, \infty)$	$(-2, -8)$ $(-1, -1)$ $(0, 0)$ $(1, 1)$ $(2, 8)$	
Quartic Equation: <u>$f(x) = x^4$</u>	$D: (-\infty, \infty)$ $R: [0, \infty)$	$(-2, 16)$ $(-1, 1)$ $(0, 0)$ $(1, 1)$ $(2, 16)$	
Absolute Value Equation: <u>$f(x) = x$</u>	$D: (-\infty, \infty)$ $R: [0, \infty)$	$(-2, 2)$ $(-1, 1)$ $(0, 0)$ $(1, 1)$ $(2, 2)$	

<p>Square Root</p> <p>Equation:</p> <p><u>$f(x) = \sqrt{x}$</u></p>	<p>D: $[0, \infty)$</p> <p>R: $[0, \infty)$</p>	<p>$(0, 0)$</p> <p>$(1, 1)$</p> <p>$(4, 2)$</p> <p>$(9, 3)$</p>	
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Transformation Rules

- $f(x) + a$ is $f(x)$ shifted upward a units
- $f(x) - a$ is $f(x)$ shifted downward a units
- $f(x + a)$ is $f(x)$ shifted left a units
- $f(x - a)$ is $f(x)$ shifted right a units
- $-f(x)$ is $f(x)$ flipped upside down ("reflected about the x -axis")
- $f(-x)$ is the mirror of $f(x)$ ("reflected about the y -axis")

Name: _____
PC: Transformations

Date: _____
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Given each original function, **describe** each transformation in terms of the original function.

1. $y = x^2$

- (a) $y = x^2 - 2$
- (b) $y = (x - 2)^2$
- (c) $y = x^2 + 2$
- (d) $y = (x + 2)^2$
- (e) $y = (-x)^2$
- (f) $y = -x^2$
- (g) $y = -(x + 1)^2$
- (h) $y = (x - 1)^2 + 3$
- (i) $y = (x + 3)^2 - 1$
- (j) $y = 2 - (x - 4)^2$

2. $y = |x|$

- (a) $y = |x| - 2$ down 2
- (b) $y = |x - 2|$ right 2
- (c) $y = |x| + 2$ up 2
- (d) $y = |x + 2|$ left 2
- (e) $y = -|x|$ reflect over x-axis
- (f) $y = -|x + 1|$ left 1, reflect over x-axis
- (g) $y = -|x| + 1$ reflect over x-axis, up 1
- (h) $y = |x + 3| - 2$ left 3, down 2
- (i) $y = -|x| - 2$ reflect over x-axis, down 2
- (j) $y = -|x - 1| + 3$ right 1, reflect over x-axis, up 3

3. $y = \sqrt{x}$

- (a) $y = \sqrt{x - 1}$
- (b) $y = \sqrt{x} + 2$
- (c) $y = \sqrt{x + 2}$
- (d) $y = -\sqrt{x}$
- (e) $y = -\sqrt{x + 1}$
- (f) $y = \sqrt{x} - 3$
- (g) $y = -\sqrt{x} + 2$
- (h) $y = -\sqrt{x - 3} + 1$
- (i) $y = -4 - \sqrt{x}$
- (j) $y = \sqrt{x - 1} + 2$

4. $y = x^3$

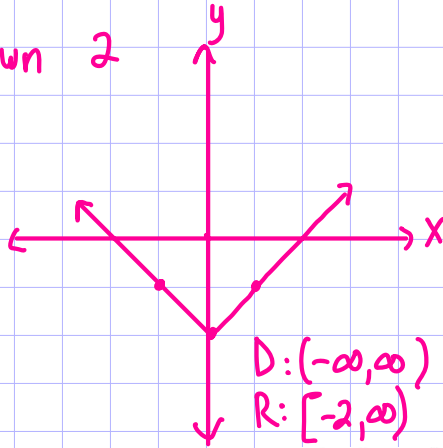
- (a) $y = (x - 1)^3$
- (b) $y = x^3 - 4$
- (c) $y = -x^3$
- (d) $y = -(x + 2)^3$
- (e) $y = (-x)^3$
- (f) $y = 2 + x^3$
- (g) $y = -4 - x^3$

2. $y = |x|$

(a) $y = |x| - 2$

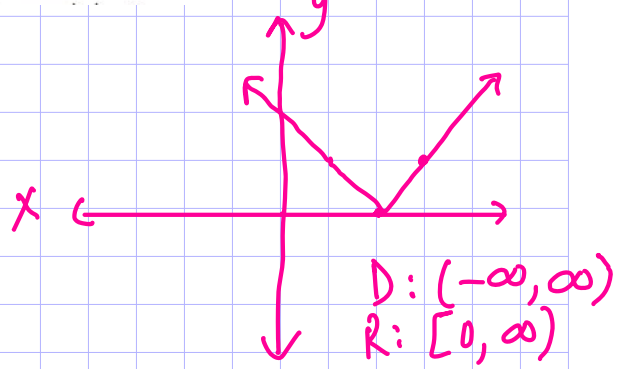
down 2

- ↓ 2
- | | |
|-----------|------------|
| $(-1, 1)$ | $(-1, -1)$ |
| $(0, 0)$ | $(0, -2)$ |
| $(1, 1)$ | $(1, -1)$ |



(b) $y = |x - 2|$

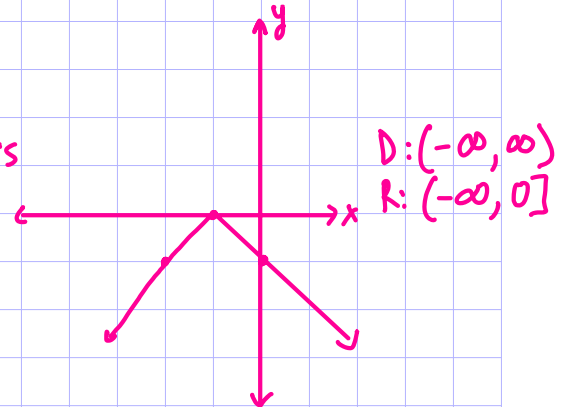
right 2



(f) $y = -|x + 1|$

left one, reflect over x-axis

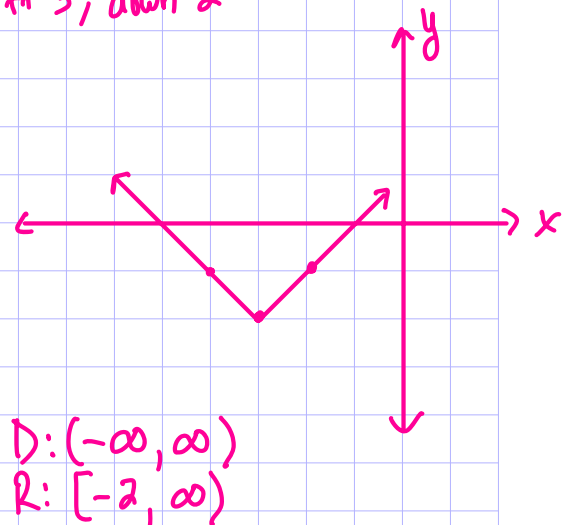
- | | | |
|-----------|-----------|---------------------|
| | left one | reflect over x-axis |
| $(-1, 1)$ | $(-2, 1)$ | $(-2, -1)$ |
| $(0, 0)$ | $(-1, 0)$ | $(-1, 0)$ |
| $(1, 1)$ | $(0, 1)$ | $(0, -1)$ |



(h) $y = |x + 3| - 2$

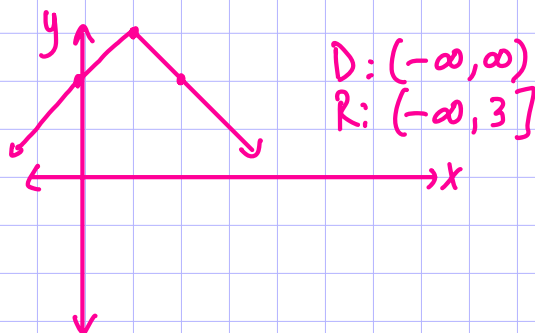
left 3, down 2

- | | | |
|-----------|-----------|------------|
| | left 3 | ↓ 2 |
| $(-1, 1)$ | $(-4, 1)$ | $(-4, -1)$ |
| $(0, 0)$ | $(-3, 0)$ | $(-3, -2)$ |
| $(1, 1)$ | $(-2, 1)$ | $(-2, -1)$ |



(i) $y = -|x-1| + 3$ right one, reflect over x-axis, $\uparrow 3$

	right one	reflect over x-axis	$\uparrow 3$
$(-1, 1)$	$(0, 1)$	$(0, -1)$	$(0, 2)$
$(0, 0)$	$(1, 0)$	$(1, 0)$	$(1, 3)$
$(1, 1)$	$(2, 1)$	$(2, -1)$	$(2, 2)$



Homework 11-09

and 11-14

Name: Key
 PC: Review of Piecewise Functions

Date: _____
 Ms. Loughran

For 1-12, evaluate the function for the given value of x .

$$f(x) = \begin{cases} 3, & \text{if } x \leq 0 \\ 2, & \text{if } x > 0 \end{cases}$$

$$g(x) = \begin{cases} x + 5, & \text{if } x \leq 3 \\ 2x - 1, & \text{if } x > 3 \end{cases}$$

$$h(x) = \begin{cases} \frac{1}{2}x - 4, & \text{if } x \leq -2 \\ 3 - 2x, & \text{if } x > -2 \end{cases}$$

1. $f(2) = 2$

2. $f(-4) = 3$

3. $f(0) = 3$

4. $f\left(\frac{1}{2}\right) = 2$

5. $g(7) = 13$

6. $g(0) = 5$

7. $g(-1) = 4$

8. $g(3) = 8$

9. $h(-4) = -6$

10. $h(-2) = -5$

11. $h(-1) = 5$

12. $h(6) = -9$

For 13-18, match the piecewise function with its graph.

E 13. $f(x) = \begin{cases} x - 4, & \text{if } x \leq 1 \\ 3x, & \text{if } x > 1 \end{cases}$

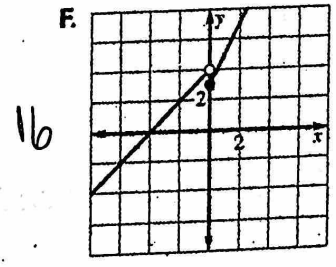
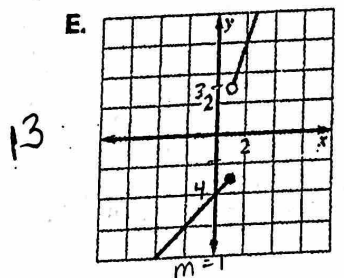
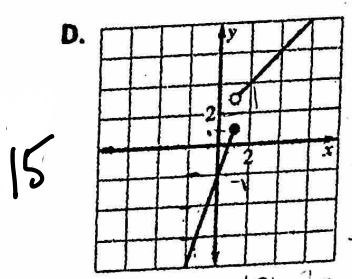
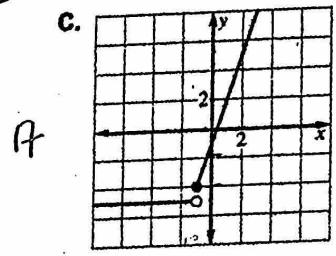
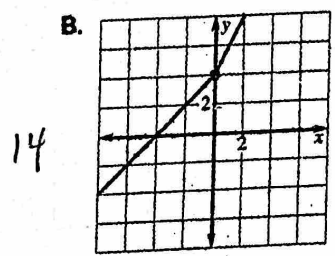
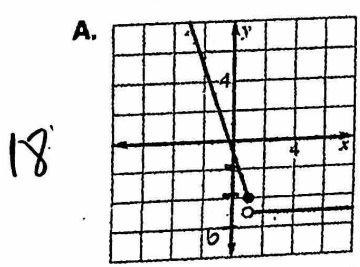
14. $f(x) = \begin{cases} x + 4, & \text{if } x \leq 0 \\ 2x + 4, & \text{if } x > 0 \end{cases}$ B

15. $f(x) = \begin{cases} 3x - 2, & \text{if } x \leq 1 \\ x + 2, & \text{if } x > 1 \end{cases}$ D

16. $f(x) = \begin{cases} 2x + 3, & \text{if } x \geq 0 \\ x + 4, & \text{if } x < 0 \end{cases}$ F

17. $f(x) = \begin{cases} 3x - 1, & \text{if } x \geq -1 \\ -5, & \text{if } x < -1 \end{cases}$ C

18. $f(x) = \begin{cases} -3x - 1, & \text{if } x \leq 1 \\ -5, & \text{if } x > 1 \end{cases}$ A



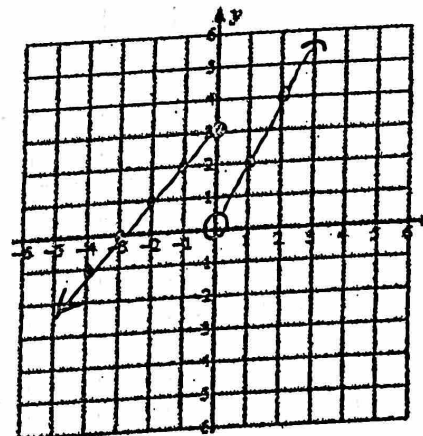
Scale
Boxes are
2 units

For 19-21, graph the function.
 19.

$$f(x) = \begin{cases} x + 3, & \text{if } x \leq 0 \\ 2x, & \text{if } x > 0 \end{cases}$$

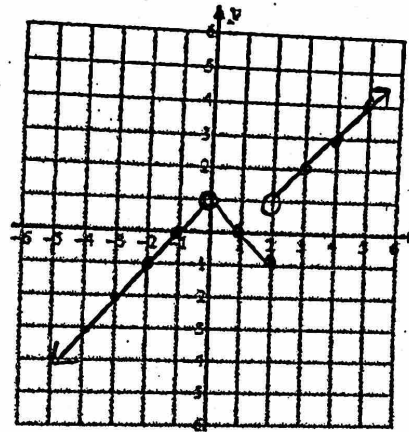
D: $(-\infty, \infty)$

R: $(-\infty, \infty)$



20.

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

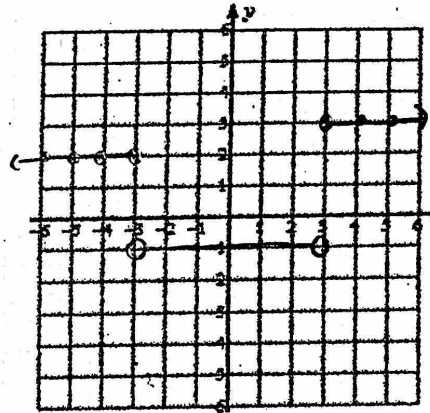


$D: (-\infty, \infty)$

$R: (-\infty, \infty)$

21.

$$f(x) = \begin{cases} 2, & \text{if } x \leq -3 \\ -1, & \text{if } -3 < x < 3 \\ 3, & \text{if } x \geq 3 \end{cases}$$

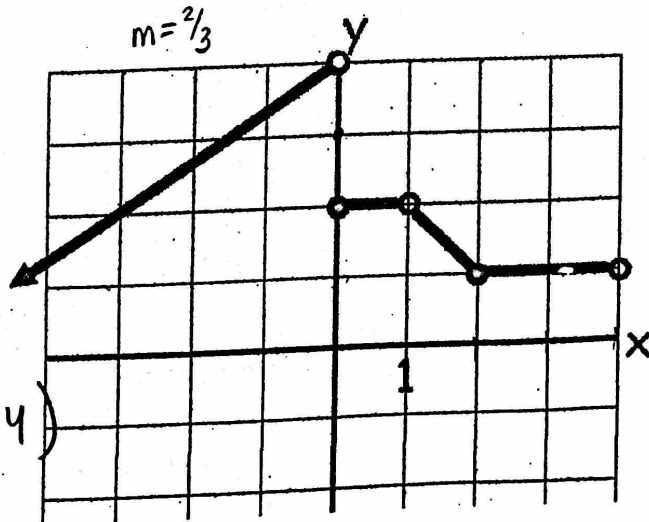


$D: (-\infty, \infty)$

$R: \{-1, 2, 3\}$

For 22-28, write functions for each of the following piecewise graphs.

22.

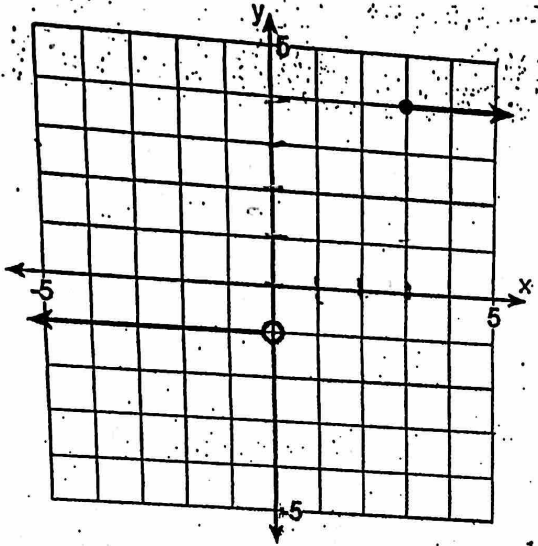


$$f(x) = \begin{cases} \frac{2}{3}x + 4 & x < 1 \\ 2 & 1 \leq x < 2 \\ -x + 3 & 2 \leq x < 4 \\ 1 & x \geq 4 \end{cases}$$

$D: (-\infty, 1) \cup (1, 4)$

$R: (-\infty, 4)$

23.

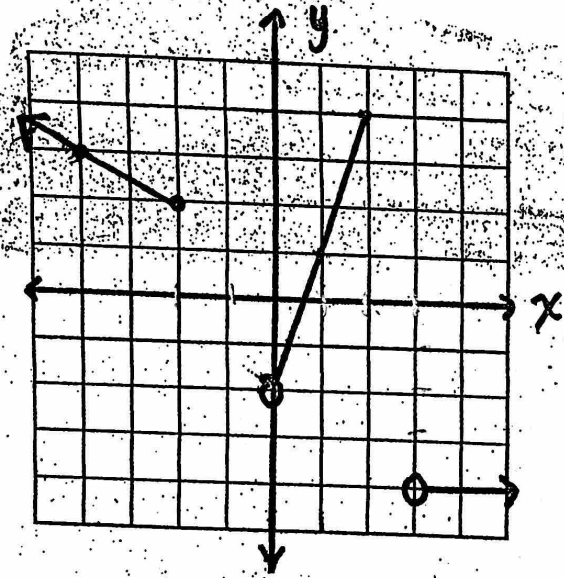


$$f(x) = \begin{cases} -1 & x < 0 \\ 4 & x \geq 3 \end{cases}$$

$$D: (-\infty, 0) \cup [3, \infty)$$

$$R: \{-1, 4\}$$

24.

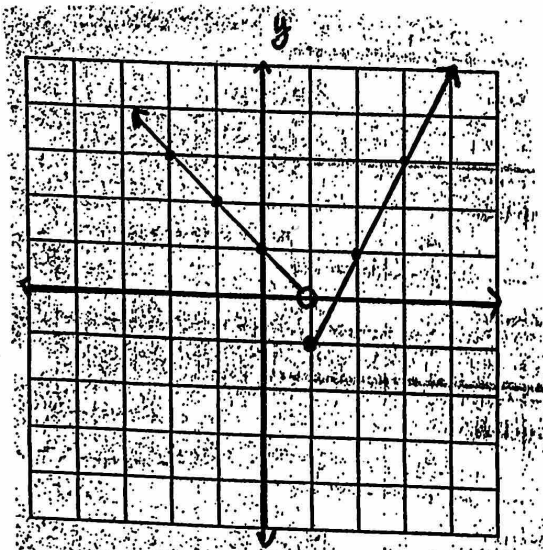


$$g(x) = \begin{cases} -\frac{1}{2}x + 1 & x \leq -2 \\ 3x - 2 & 0 < x \leq 2 \\ -4 & x > 3 \end{cases}$$

$$D: (-\infty, -2] \cup (0, 2] \cup (3, \infty)$$

$$R: \{-4\} \cup (-2, \infty)$$

25.

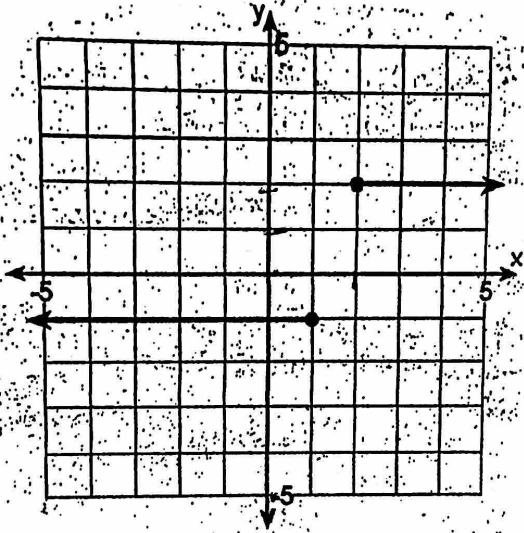


$$f(x) = \begin{cases} -x + 1 & x < 1 \\ 2x - 3 & x \geq 1 \end{cases}$$

$$D: (-\infty, \infty)$$

$$R: [-1, \infty)$$

26.

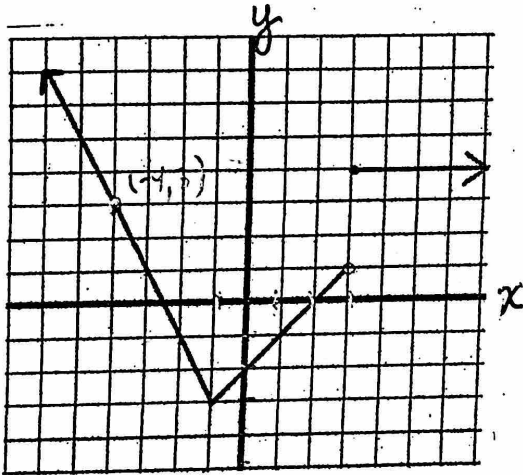


$$f(x) = \begin{cases} 2 & x \geq 2 \\ -1 & x \leq 1 \end{cases}$$

$$D: (-\infty, 1] \cup [2, \infty)$$

$$R: \{-1, 2\}$$

27.



$$f(x) = \begin{cases} -2x - 5 & x < -1 \\ x - 2 & -1 \leq x < 3 \\ 4 & x \geq 3 \end{cases}$$

$$D: (-\infty, \infty)$$

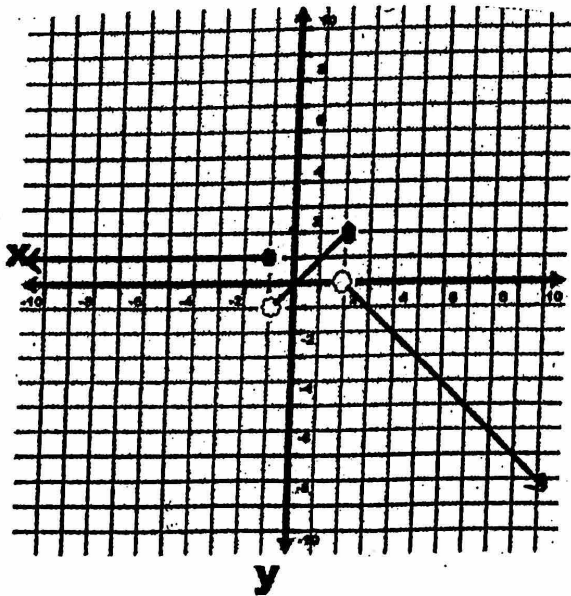
$$R: [-3, \infty)$$

$$y - 3 = -2(x + 4)$$

$$y - 3 = -2x - 8$$

$$y - 3 = -2x - 5$$

28.



$$g(x) = \begin{cases} 1 & x \leq -1 \\ x & -1 < x \leq 2 \\ -x + 2 & x > 2 \end{cases}$$

$$D: (-\infty, \infty)$$

$$R: (-\infty, 2]$$