1.1 and 1.2 Lines, Functions, and Graphs

Slope

$$m = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

Parallel and Perpendicular Lines

Parallel lines have the same slope, and perpendicular lines have negative reciprocal slopes

$\left(m \text{ and } m \text{ for parallel, } m \text{ and } \frac{-1}{m} \text{ for perpendicular}\right)$.

Equations of Lines

Point – Slope Form → $y - y_1 = m(x - x_1)$

Slope – Intercept Form → $y = mx + b$

General (or Standard) Form → $Ax + By = C$ (where A, B, and C are integers, if possible)

For problems 1 – 3, find the equation of the line in the indicated form.

1. through $(-2, 3)$ and $(4, -2)$ in Point – Slope form

$m = \frac{-2 - 3}{4 - (-2)} = \frac{-5}{6}$ so $y - 3 = \frac{-5}{6}(x - (-2))$

or $y = \frac{-5}{6}x - \frac{5}{3} + 3$ → $\boxed{y = \frac{-5}{6}x + \frac{4}{3}}$

2. through $(-1, -3)$ and $(4, -3)$ in General form

$m = \frac{-3 - (-3)}{4 - (-1)} = 0$ so $y - (-3) = 0(x -$

or $\boxed{y = -3}$

3. through $(-5, 1)$ and $(0, 4)$ in Slope – Intercept form

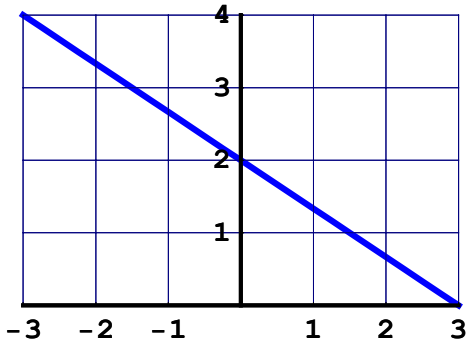
$m = \frac{4 - 1}{0 - (-5)} = \frac{3}{5}$ and $(0, 4)$ means that we have a y – intercept of 4, so $\boxed{y = \frac{3}{5}x + 4}$

For problems 4 and 5, find (a) the slope, and (b) the y – intercept, and (c) graph the line.

4. $2x + 3y = 6$

(a) $3y = -2x + 6$ so $y = \frac{-2}{3}x + 2$

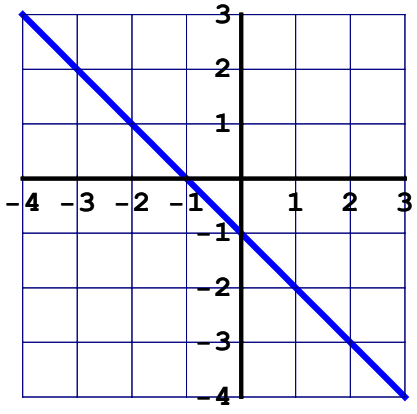
so the $\boxed{\text{slope is } -\frac{2}{3}}$ (b) $\boxed{y \text{ – intercept is } 2}$



5. $y - 2 = -(x + 3)$

(a) $y = -x - 1$ so the $\boxed{\text{slope is } -1}$

(b) $\boxed{y \text{ – intercept is } -1}$



6. Find the equation of the line through the point $(2, 1)$ and perpendicular to the line $x + 2y = 7$

$2y = -x + 7$ so $y = \frac{-1}{2}x + \frac{7}{2}$ so the slope of the new line is $\frac{-1}{2}$ and the equation of the line is

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

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7. Find the equation of the line in Slope – Intercept form that passes through the points $(3, 1)$, $(9, -1)$, and $\left(-2, \frac{8}{3}\right)$

$$m = \frac{-1 - 1}{9 - 3} = \frac{-2}{6} = \frac{-1}{3} \quad \text{so} \quad y - 1 = \frac{-1}{3}(x - 3) \quad \rightarrow \quad \boxed{y = \frac{-1}{3}x + 2}$$

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8. Find y if the line through $(-3, y)$ and $(1, -2)$ has slope $\frac{-3}{4}$

$$\frac{-2 - y}{1 - (-3)} = \frac{-3}{4} \quad \rightarrow \quad -12 = 4(-y - 2) \quad \rightarrow \quad -3 = -y - 2 \quad \rightarrow \quad 3 = y + 2 \quad \rightarrow \quad \boxed{y = 1}$$

Function Definition

A function from a set D to a set R is a rule that assigns a *unique* element in R to each element in D. For example if the points $(1, 2)$ and $(1, 5)$ are in the set, then it is not a function.

Even and Odd Functions

Even: $f(x) = f(-x)$ (symmetry with respect to the y – axis)

Odd: $f(x) = -f(-x)$ (symmetry with respect to the origin)

Interval Notation

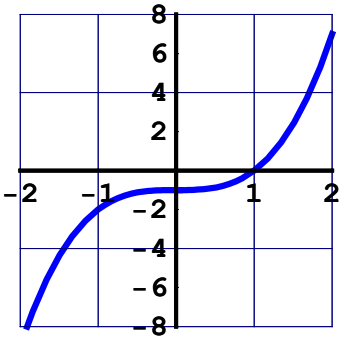
(1)	(a, b)	$\rightarrow$	$a < x < b$	(2)	$(a, b]$	$\rightarrow$	$a < x \le b$
(3)	$[a, b)$	$\rightarrow$	$a \le x < b$	(4)	$[a, b]$	$\rightarrow$	$a \le x \le b$
(5)	(a, ∞)	$\rightarrow$	$a < x$	(6)	$[a, \infty)$	$\rightarrow$	$a \le x$
(7)	$(\infty, a]$	$\rightarrow$	$x \le a$	(8)	(∞, a)	$\rightarrow$	$x < a$

For problems 1 – 4, find (a) the domain, (b) the range, and (c) any symmetry

1. $y = x^3 - 1$

(a) D: All Reals (b) All Reals

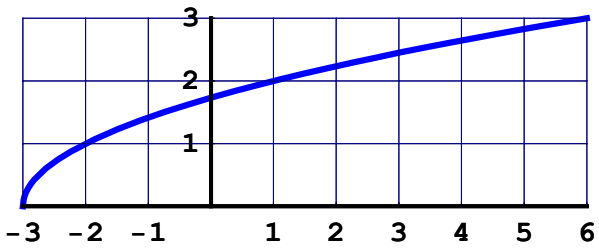
(c) $f(x) \neq f(-x)$ and $f(x) \neq -f(-x)$, neither



2. $y = \sqrt{x + 3}$

(a) D: $[-3, \infty)$ (b) R: $[0, \infty)$

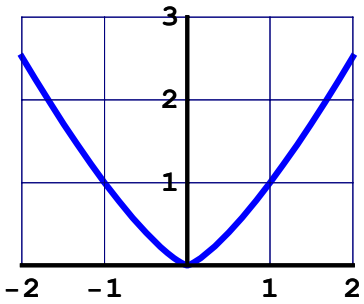
(c) $f(x) \neq f(-x)$ and $f(x) \neq -f(-x)$, neither



3. $y = x^{\frac{4}{3}}$

(a) D: All Reals (b) R: $[0, \infty)$

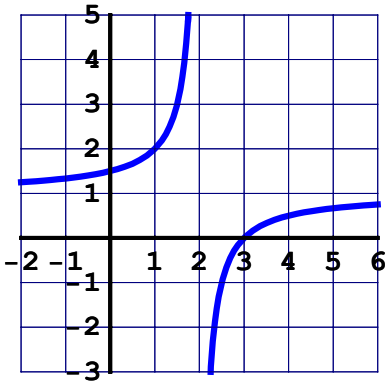
(c) $f(x) = f(-x)$, even



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

(a) D: $(-\infty, 2) \cup (2, \infty)$ (b) R: $(-\infty, 1) \cup (1, \infty)$

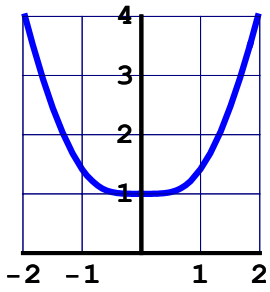
(c) $f(x) \neq f(-x)$ and $f(x) \neq -f(-x)$, neither



For problems 5 – 7, determine whether the function is even, odd, or neither.

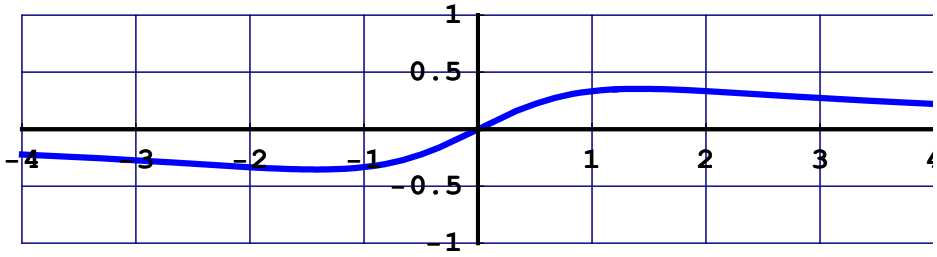
5. $y = \sqrt{x^4 + 1}$

$f(x) = f(-x)$ even



6. $y = \frac{x}{x^2 + 2}$

$f(x) = -f(-x)$, odd



7. $y = x + x^3 + 1$

$f(x) \neq f(-x)$ and $f(x) \neq -f(-x)$, neither