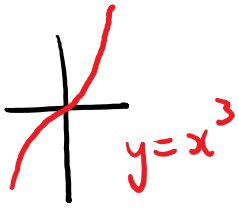
2.2 Cont'd

Ex: Test $y = x^3$ for symmetry



1) **x-axis symmetry**
$y \to -y$

$-y = x^3$ ✗

No

2) **y-axis symmetry**
$x \to -x$

$y = (-x)^3$

$y = -x^3$ ✗

No

3) **symmetry about origin (rotation by 180°)**
$x \to -x$
$y \to -y$

$-y = (-x)^3$

$-y = -x^3$

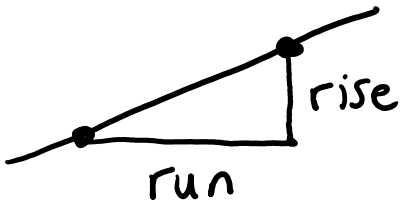
$y = x^3$ ✓

YES

$(-1)^{\text{even}} = 1$
$(-1)^{\text{odd}} = -1$
$(-x)^n = (-1)^n x^n$
$(-x)^2 = x^2$
$(-x)^3 = -x^3$
$(-x)^{20} = x^{20}$
$(-x)^{31} = -x^{31}$

2.3 Lines

slope $m = \frac{\text{rise}}{\text{run}}$



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

Ex: Find the slope of the line through $(4,11)$ and $(2,8)$

(x_1, y_1)

$$m = \frac{8-11}{2-4}$$

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

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

Two special cases

- Vertical Line | has m = undefined

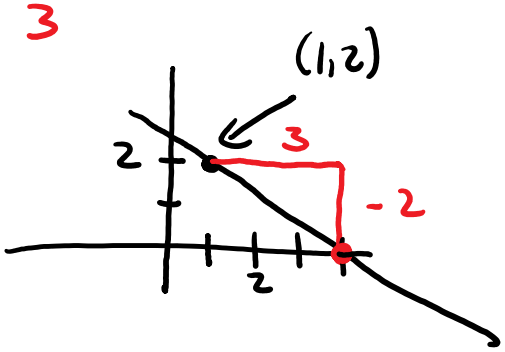
  Equation: $x = \#$

- Horizontal Line ——— has $m = 0$

  Equation: $y = \#$

Ex: Graph the line through $(1,2)$ with $m = -\frac{2}{3}$ ← $\frac{\text{rise}}{\text{run}}$

rise $= -2$
run $= 3$



General Form $Ax + By = C$

Slope-Intercept Form $y = mx + b$

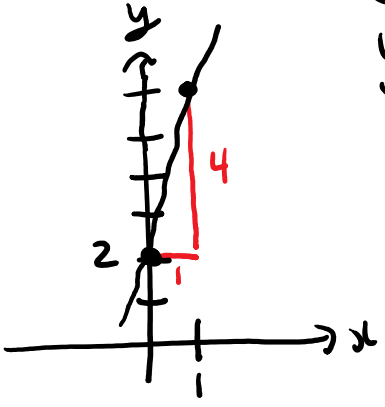
m: slope
b: y-intercept

Ex: Graph $-12x + 3y = 6$

$3y = 12x + 6$

$y = 4x + 2$

slope: 4 y-intercept: 2



Point-Slope Form

Point-Slope Form

$$y - y_1 = m(x - x_1)$$ ★

Ex: Find equation of line through $(-2, 7)$ and $(1, 13)$

1) Slope

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

$$= \frac{13 - 7}{1 - (-2)}$$

$$= \frac{6}{3}$$

$$= 2$$

2) $y - y_1 = m(x - x_1)$

$x_1 = -2$
$y_1 = 7$:

$$y - 7 = 2(x + 2)$$

$$y - 7 = 2x + 4$$

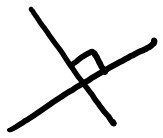
↙ ↘

$-2x + y = 11$ — General Form

$y = 2x + 11$ — Slope-Intercept Form

Parallel Lines
slopes are equal

$m_1 = m_2$



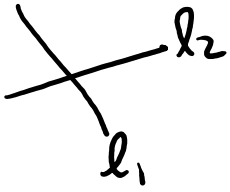
Perpendicular Lines $m_2 = \frac{-1}{m_1}$

Ex: Find the line l_2 through $(1,4)$ that's perpendicular to l_1: $3x + y = -12$

1) Slope of l_2?

slope of l_1: $y = -3x - 12$

$\boxed{m = -3}$



$$m_2 = \frac{-1}{m_1}$$

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

$$= \frac{1}{3} \leftarrow \text{slope of } l_2$$

2) $y - y_1 = m(x - x_1)$

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

$(x_1, y_1) = (1,4)$

:

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

In slope-intercept form:

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

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

$$y = \frac{1}{3}x + \frac{11}{3}$$