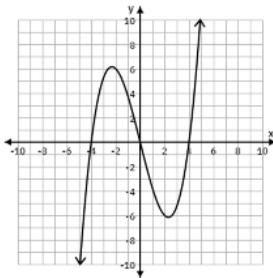# STATION A

1. Determine if the relations below are **linear** or **non-linear**. Justify your answer.

a) $y = 3x - 1$

Linear. In the form
$y = mx + b$
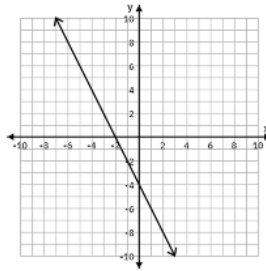
b) $y = 2^x$

Non-linear. Variable
as an exponent

c) $y = \dfrac{1}{x} + 4$

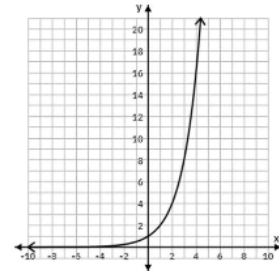Non-linear. Variable
in the denominator.

d)

Non-linear.
Not a line.

e)

Linear.
Straight line.

f)

Non-linear.
Not a line.

2. Determine if the following tables of values represent linear relations. **Show your thinking/justification!**

a)

x	y	1st diff.
−2	17	
0	21	4
2	25	4
4	29	4
6	33	4

+2 ⟨, +2 ⟨, +2 ⟨, +2 ⟨

Linear. 1st differences
are constant.

b)

x	y	1st diff
−5	50	
−4	49	−1
−3	47	−2
−2	44	−3
−1	40	−4

+1 ⟨, +1 ⟨, +1 ⟨, +1 ⟨

Non-linear. 1st diff.
is not constant.

c)

x	y	Δy	RoC
0	1		
3	7	+6	$\frac{6}{3} = 2$
4	9	+2	$\frac{2}{1} = 2$
6	13	+4	$\frac{4}{2} = 2$
7	15	+2	$\frac{2}{1} = 2$

Δx: +3, +1, +2, +1

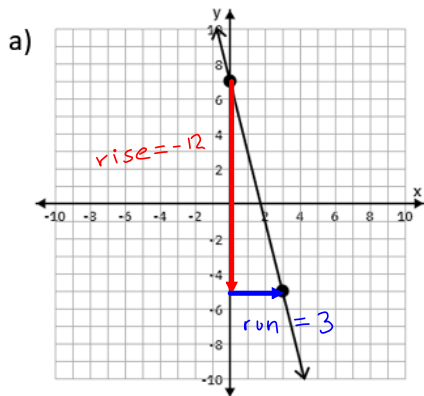Linear. The slope (RoC)
is the same throughout
the table.

3. Determine the equations of the table in questions 2a and 2c.

a) $m = \dfrac{\Delta y}{\Delta x}$ $b = 21$

$= \dfrac{4}{2}$ $\therefore y = 2x + 21$

$= 2$
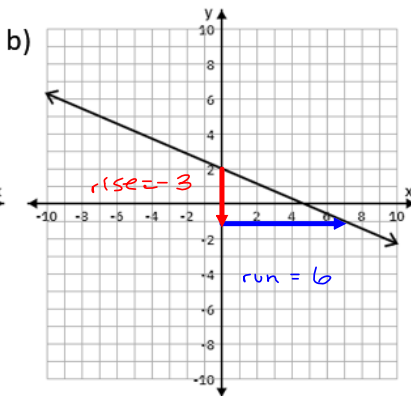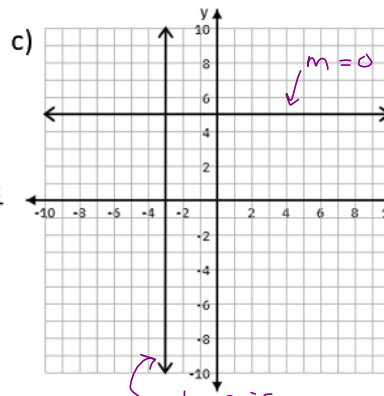
c) $m = 2$ $b = 1$

$\therefore y = 2x + 1$

STATION B

1. Determine the slope of the following lines (find the equations of both lines for c).

a)

rise = -12
run = 3

$\therefore m = -4$

$m = \dfrac{rise}{run}$

$= \dfrac{-12}{3}$

$= -4$

b)

rise = -3
run = 6

$m = \dfrac{rise}{run}$

$= \dfrac{-3}{6}$

$= -\dfrac{1}{2}$

c)

m = 0

slope is undefined

2. Determine the equations of each of the lines in question 2.

a) $y = -4x + 7$ b) $y = -\dfrac{1}{2}x + 2$ c) horizontal: $y = 5$
                                                          vertical: $x = -3$

3. Determine the slope of the line that passes through the following pairs of points.

a) $(-3, 7)$ and $(2, 17)$

$\Delta x \begin{array}{c|c} x & y \\ \hline -3 & 7 \\ 2 & 17 \end{array} \Delta y$

$+5 \quad \quad +10$

$m = \dfrac{\Delta y}{\Delta x}$

$= \dfrac{10}{5}$

$= 2$

$\boxed{\therefore m = 2}$

b) $(18, 5)$ and $(-5, 5)$

$\Delta x \begin{array}{c|c} x & y \\ \hline 18 & 5 \\ -5 & 5 \end{array} \Delta y$

$-23 \quad \quad 0$

$m = \dfrac{\Delta y}{\Delta x}$

$= \dfrac{0}{-23}$

$= 0$

$\boxed{\therefore m = 0}$

c) $(-6, 7)$ and $(1, 3)$

$\Delta x \begin{array}{c|c} x & y \\ \hline -6 & 7 \\ 1 & 3 \end{array} \Delta y$

$+7 \quad \quad -4$

$m = \dfrac{\Delta y}{\Delta x}$

$= \dfrac{-4}{7}$

$\boxed{\therefore m = \dfrac{-4}{7}}$

d) $(2, 3)$ and $(2, -5)$

$\Delta x \begin{array}{c|c} x & y \\ \hline 2 & 3 \\ 2 & -5 \end{array} \Delta y$

$+0 \quad \quad -8$

$m = \dfrac{\Delta y}{\Delta x}$

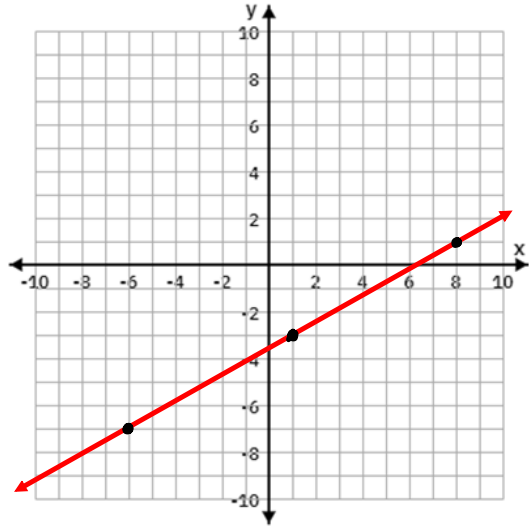$= \dfrac{-8}{0}$

undefined.

$\therefore$ The slope is undefined.

STATION C

1. Sketch a line that has a slope of $\frac{4}{7}$ and goes through the point $(1, -3)$.

$$m = \frac{4 \uparrow}{7 \rightarrow}$$
$$= \frac{-4 \downarrow}{-7 \leftarrow}$$

2. A line segment $\overline{AB}$ starts at the point $A(3,4)$. If the slope is $-\frac{2}{3}$, what is a possible coordinate for the point B?

Many answers possible.   Ex: $(6, 2)$

※ Any point that satisfies the equation
$$y = \frac{-2}{3}x + 6$$

3. An accessibility ramp needs to have a slope of **at most** $\frac{1}{10}$ to pass inspection in Ontario. A store is planning to install a new ramp that goes up 0.5 meters in height over a distance of 4.6 meters. Would this ramp pass inspection?

$$m = \frac{rise}{run}$$
$$= \frac{0.5}{4.6}$$
$$\doteq 0.1087$$

∴ The slope is steeper than $\frac{1}{10}$ so it would not pass inspection.

※ $\frac{1}{10} = 0.1$

STATION D

1. Organize the following lines from **least** steep, to **most** steep.

$$y = -5x + 1, \quad y = x + 5, \quad y = -3x - 2, \quad y = -\frac{3}{5}x, \quad y = 4x - 5$$

least   most

$$y = -\frac{3}{5}x, \quad y = x + 5, \quad y = -3x - 2, \quad y = 4x - 5, \quad y = -5x + 1$$

2. Describe how each of the following lines has been transformed compared to the parent function $y = x$.

a) $y = x + 5$

Translated up 5 units.

b) $y = x - 2$

Translated down 2 units.

3. For each of the following lines, write an equation of a line that is **parallel.**

a) $y = 2x - 5$

$$y = 2x - 2$$

b) $y = \frac{3}{7}x$

$$y = \frac{3}{7}x + 5$$

c) $y = -9x - 1$

$$y = -9x$$

* Many answers possible. Can have different y-intercept.

4. For each of the following lines, write an equation of a line that is **perpendicular.**

a) $y = 5x - 1$

$$y = -\frac{1}{5}x + 2$$

b) $y = -\frac{1}{7}x$

$$y = 7x - 5$$

c) $y = \frac{2}{3}x + 2$

$$y = -\frac{3}{2}x + 1$$

* Many answers possible. Can have different y-intercept.

STATION E

1. For the following lines, identify the slope, the y-intercept and use these to graph the line.
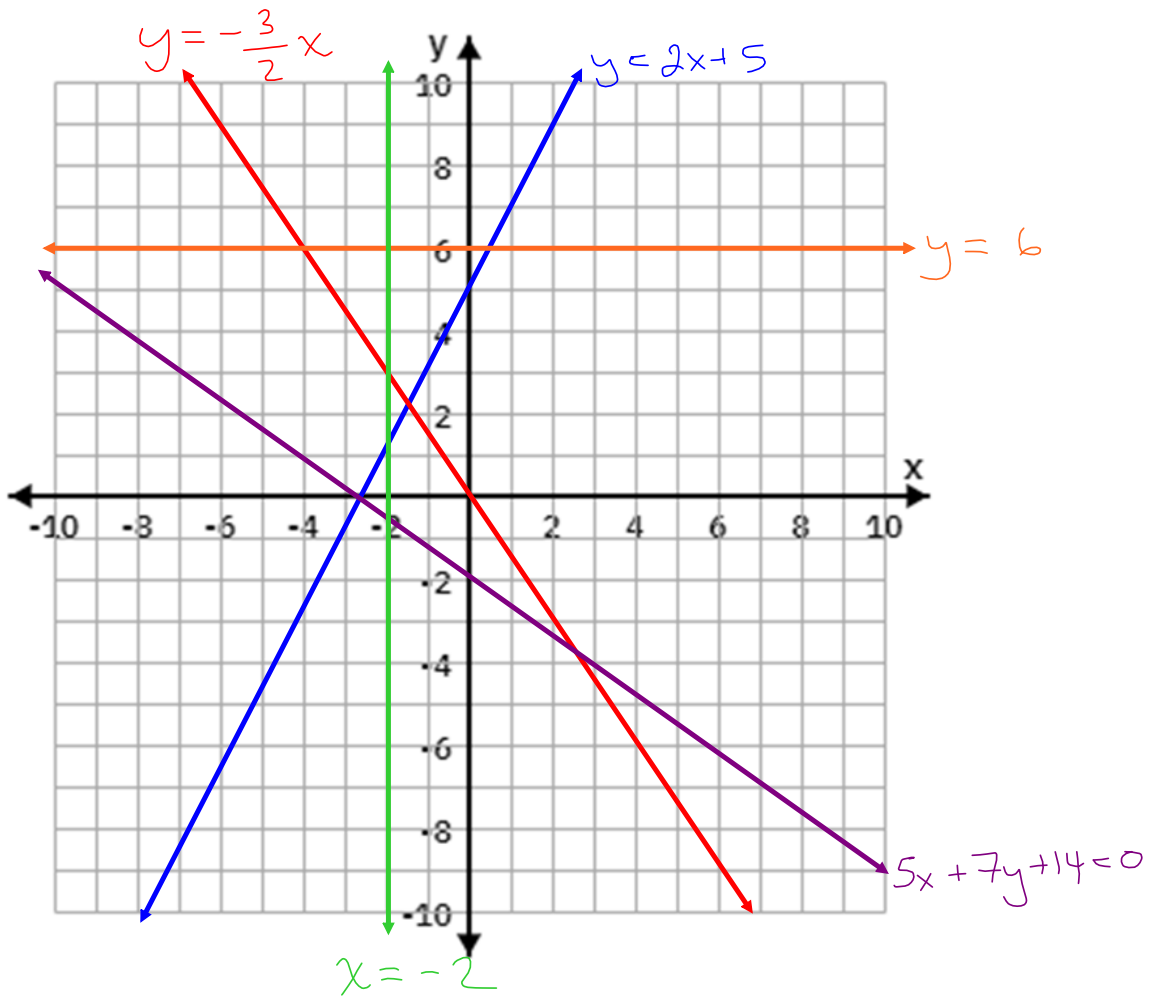
a) $y = 2x + 5$ Slope: __2__ y-intercept: __5__

b) $y = -\frac{3}{2}x$ Slope: __$-\frac{3}{2}$__ y-intercept: __0__

c) $5x + 7y + 14 = 0$ Slope: __$-\frac{5}{7}$__ y-intercept: __-2__

d) $y = 6$ Slope: __0__ y-intercept: __6__

e) $x = -2$ Slope: __undefined__ y-intercept: __none__

c) $5x + 7y + 14 = 0$

$$\frac{7y}{7} = \frac{-5x}{7} - \frac{14}{7}$$

$$y = -\frac{5}{7}x - 2$$

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

$y = 2x + 5$

$y = 6$

$x = -2$

$5x + 7y + 14 = 0$

STATION F

1. Determine the equation of the line that has the following properties:

a) Has a slope of -3 and a y-intercept of 2.

$$\therefore \quad y = -3x + 2$$

b) Is horizontal and goes through the point $(1,4)$.

$$y = b$$
$$\text{sub } (1,4)$$
$$4 = b$$

$$\therefore \quad y = 4$$

c) Has a slope of 6 and passes through the point $(-3, -8)$.

$$y = 6x + b$$
$$\text{sub}(-3, -8)$$
$$-8 = 6(-3) + b$$
$$-8 = -18 + b$$
$$+18 \qquad +18$$
$$10 = b$$

$$\therefore \quad y = 6x + 10$$

d) Is vertical and goes through the point $(8, -2)$.

$$x = a$$
$$\text{sub } (8, -2)$$
$$8 = a$$

$$\therefore \quad x = 8$$

2. Determine the equations of the line that passes through the following points.

a) $(3, 13)$ and $(5, 25)$

Δx	x	y	Δy
$+2$	3	13	$+12$
	5	25	

$$m = \frac{\Delta y}{\Delta x}$$
$$= \frac{12}{2}$$
$$= 6$$

$$y = 6x + b$$
$$\text{sub } (3, 13) \quad \text{or } (5, 25)$$
$$13 = 6(3) + b$$
$$13 = 18 + b$$
$$-18 \quad -18$$
$$-5 = b$$

$$\therefore \quad y = 6x - 5$$

b) $(7, -3)$ and $(14, -11)$

Δx	x	y	Δy
$+7$	7	-3	-8
	14	-11	

$$m = \frac{\Delta y}{\Delta x}$$
$$= \frac{-8}{7}$$

$$y = \frac{-8}{7}x + b$$
$$\text{sub} (7, -3) \text{ or } (14, -11)$$
$$-3 = \frac{-8}{7}(7) + b$$
$$-3 = -8 + b$$
$$+8 \quad +8$$
$$5 = b$$

$$\therefore \quad y = \frac{-8}{7}x + 5$$

c) $(2,2)$ and $(-2,3)$

Δx	x	y	Δy
-4	2	2	$+1$
	-2	3	

$$m = \frac{\Delta y}{\Delta x}$$
$$= \frac{1}{-4}$$
$$= -\frac{1}{4}$$

$$y = -\frac{1}{4}x + b$$
$$\text{sub } (2,2)$$
$$2 = -\frac{1}{4}(2) + b$$
$$2 = -\frac{1}{2} + b$$
$$+\frac{1}{2} \qquad +\frac{1}{2}$$
$$2 + \frac{1}{2} = b$$
$$\frac{5}{2} = b$$

$$\therefore \quad y = -\frac{1}{4}x + \frac{5}{2}$$

STATION G

1. Determine the equation of a line that satisfies the following properties:

a) Is parallel to the line $y = 2x - 5$ and crosses through the point $(4, -2)$

$m = 2$

$y = 2x + b$

sub $(4, -2)$

$-2 = 2(4) + b$

$-2 = 8 + b$

$-10 = b$

$\therefore y = 2x - 10$

b) Is perpendicular to the line $y = \frac{3}{2}x - 4$ and crosses through the origin.

$m = -\frac{2}{3}$ $b = 0$

$\therefore y = -\frac{2}{3}x$

2. Hikaru paid a gym $29 in December when they only went 6 times. In January they made a New Years resolution to go more often and had to pay $77 for attending 18 times.

a) Determine an equation that represents this situation. **Define your variables!**

Let C be the monthly cost ($) and n be the # of days they hit the gym.

n	C
6	29
18	77

$6n$ $\downarrow$ $+12$ $\downarrow$ $+48$ ΔC

$m = \frac{\Delta C}{\Delta n}$

$= \frac{48}{12}$

$= 4$

$C = 4n + b$

sub $(6, 29)$

$29 = 4(6) + b$

$29 = 24 + b$

$-29 \quad -24$

$5 = b$

$\therefore C = 4n + 5$

b) What might the slope and y-intercept represent in this situation?

Slope: cost to attend gym per session

y-int : monthly fee (fixed cost)

c) How much would it cost if Hikaru went to the gym 30 times in one month?

$n = 30$

$C = 4(30) + 5$

$= 120 + 5$

$= 125$

$\therefore$ It would cost $125.

d) How many times did Hikaru go to the gym if they paid $57?

$C = 57$

$57 = 4n + 5$

$-5 \qquad -5$

$\frac{52}{4} = \frac{4n}{4}$

$13 = n$

$\therefore$ Hikaru went 13 times.

STATION H

1. Determine the equation of a line that satisfies the following properties:

a) Is parallel to the line $5x - 3y + 2 = 0$ and has the same y-intercept as $7x = 2y + 8$

$5x - 3y + 2 = 0$
$\qquad +3y \qquad +3y$

$\dfrac{5x}{3} + \dfrac{2}{3} = \dfrac{3y}{3}$

$\dfrac{5}{3}x + \dfrac{2}{3} = y$

$\Rightarrow m = \dfrac{5}{3}$

① $7x = 2y + 8$

$7x - 8 = 2y$

$\dfrac{7}{2}x - 4 = y$

$\Rightarrow b = -4$

② Set $x = 0$

$7(0) = 2y + 8$

$0 = 2y + 8$

$-8 = 2y$

$-4 = y$

$\Rightarrow b = -4$

$\therefore \; y = \dfrac{5}{3}x - 4$

b) Has the same y-intercept as the line that crosses through the points $(7,1)$ and $(2,-4)$ and is perpendicular to the line $2x - 5y - 3 = 0$.

x	y
7	1
2	-4

$-5 \curvearrowleft \quad \curvearrowright +5$

$m = \dfrac{\Delta y}{\Delta x}$
$= \dfrac{5}{-5}$
$= -1$

$y = -x + b$

sob $(7,1)$

$1 = -7 + b$
$\;\; +7 \quad +7$

$\boxed{8 = b}$

$2x - 5y - 3 = 0$

$2x - 3 = 5y$

$\dfrac{2}{5}x - \dfrac{3}{5} = y$

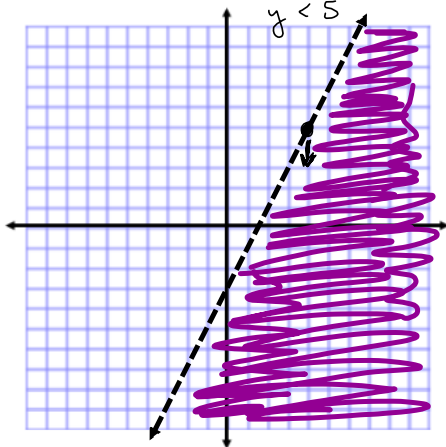$\curvearrowright y = \dfrac{2}{5}x - \dfrac{3}{5}$

perp. slope: $\dfrac{-5}{2}$

$\therefore \; y = \dfrac{-5}{2}x - 1$

2. Graph the region that represents the following inequalities. Show your work!

a) $y < 2x - 3$

$x = 4$

$y < 2(4) - 3$
$y < 5$

b) $y \geq -\dfrac{2}{3}x + 1$

$x = 0$

$y \geq -\dfrac{2}{3}(0) + 1$
$y \geq 1$