2.4 linear functions & lines

Objective. To give the general equations of lines & linear fn
- to define the slope of a fn.
- to learn how to graph linear fns & lines.

Standard Equation of a line is

$$Ax + By = C$$

Exp $2x + 3y = 1$

$x = -2$

$y = 7$

A linear function is a function of the form

$f(x) = ax + b \qquad a, b \in \mathbb{R}$

Its graph is a line.

The domain is $(-\infty, \infty)$

The range is $= (-\infty, \infty)$ if $a \neq 0$

$= \{b\}$ if $a = 0$

Exp 1 Graph $f(x) = 2x + 1$ & give its range

Exp 2. Graph $g(x) = -3$ & give its domain & range

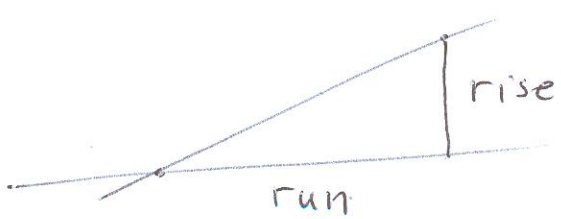
Exp 3: Graph the line $x = -5$ & give its domain & Range.

Exp 4. Graph $2x - 3y = 1$

Slope.

The slope of a line passing through $P_1(x_1, y_1)$ & $P_2(x_2, y_2)$ is

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



Properties: Let L be a line with slope m

1) If L is horizontal $\Rightarrow$ $m = 0$

2) If L is vertical $\Rightarrow$ slope is undefined (or no slope)

3) If $m \neq 0 \Rightarrow$ L is the graph of a linear function

& if $m > 0 \Rightarrow$ increasing f^{n}.

if $m < 0 \Rightarrow$ decreasing f^{n}.

Exps. Find the slopes of the lines with the given points.

a) $(-3, 7)$, $(4, 8)$ b) $(2, -3)$, $(7, 2)$

Sol^{n}. a) $m = \dfrac{8-7}{4-(-3)} = \dfrac{1}{7}$

Slopes from equations

eq^{n}	Slope	y-int
$y = ax + b$	$m = a$	$y = b$
$Ax + By = C$	$m = -\dfrac{A}{B}$ $(B \neq 0)$	$y = \dfrac{C}{B}$

Exp6. Find the slopes of

a) $3x - 4y = 7$ b) $f(x) = -5x + 2$

Sol. a) $A = 3, \quad B = -4, \quad C = 7$

$$\Rightarrow m = -\frac{A}{B} = -\frac{3}{-4} = \frac{3}{4}$$

b) $f(x) = -5x + 2 \Rightarrow a = -5, \quad b = 2$

$$\Rightarrow m = a = -5$$

Exp7. Graph the following

a) a line passing through $(-2, -1)$ & slope $m = +3/4$

b) $f(x) = 2x - 3$ d) $x = -2$

c) $3x + 4y = 2$. f) $f(x) = 3$

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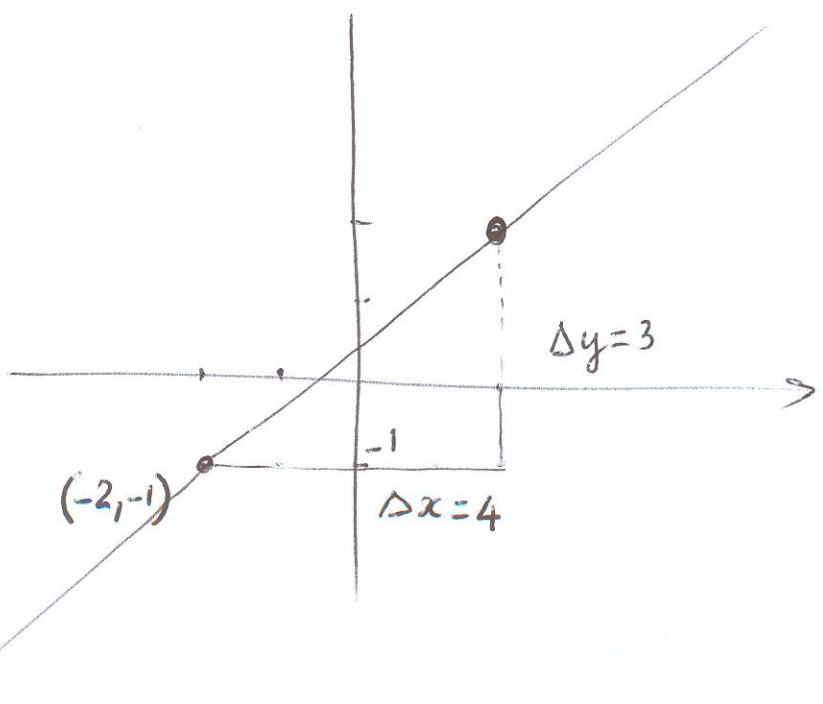
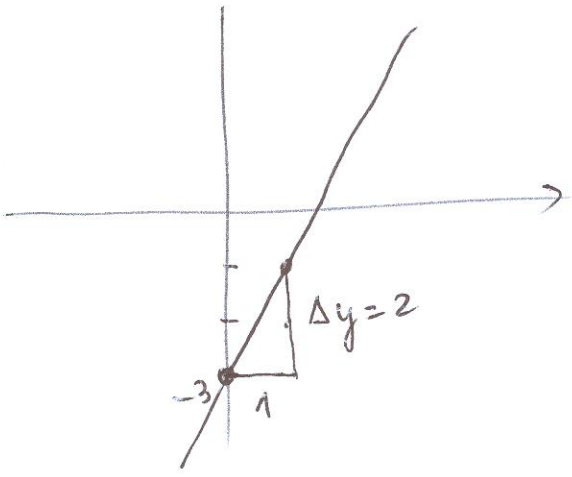
a) $m = +\frac{3}{4} = \frac{+3}{4} = \frac{\Delta y}{\Delta x} \Rightarrow$ take $\Delta x = 4, \Delta y = 3$



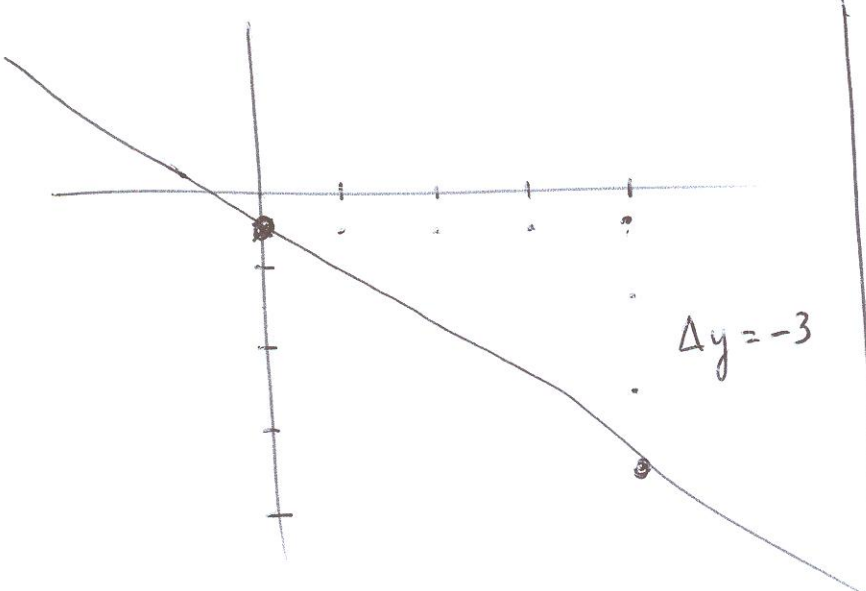
b) $f(x) = 2x - 3 \Rightarrow$ y-int $= -3$, $m = 2 = \frac{2}{1} = \frac{\Delta y}{\Delta x}$



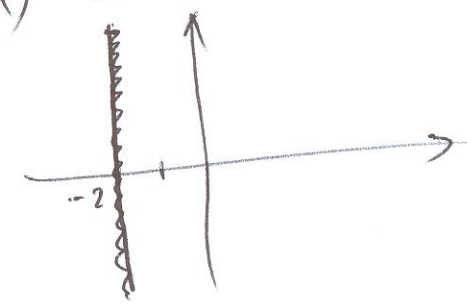
c) $3x + 4y = 2 \Rightarrow y = -\frac{3}{4}x + \frac{2}{4}$

y-int $= 2/4 = 1/2 \rightarrow$ pt $= (0, 1/2)$

$m = -\frac{3}{4} = \frac{-3}{4} =$



d) $x = -2$



f) $f(x) = 3$