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SOLUTIONS KEY

FOM 10

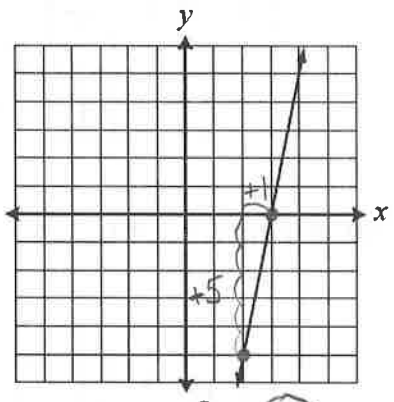
***Chapter 5 - Linear Functions PRACTICE Unit Test**

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

*circle final answers

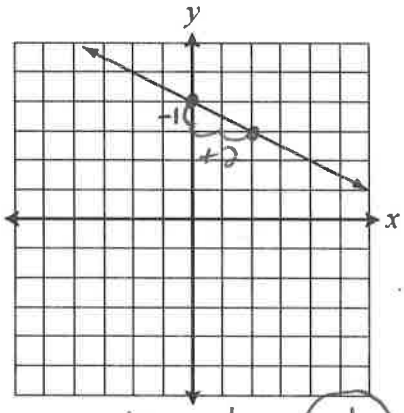
1. Determine the **slope** of the following graphs (1 mark each):

a.



$m = \frac{\text{rise}}{\text{run}} = \frac{+5}{+1} = 5$

b.



$m = \frac{\text{rise}}{\text{run}} = \frac{-1}{2} = -\frac{1}{2}$

2. Find the slope of the line containing each pair of points (1 marks each):

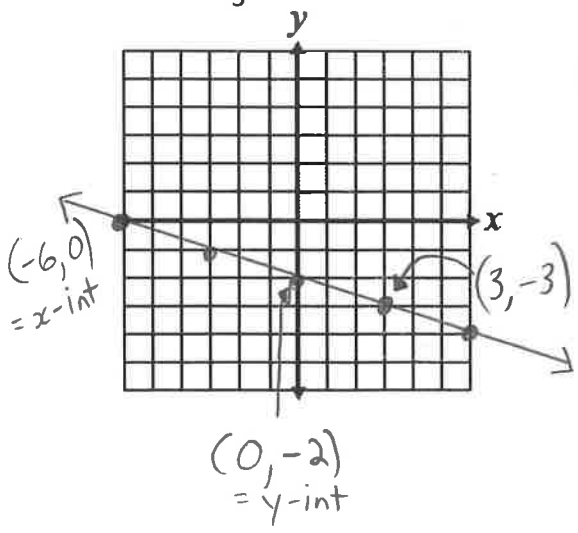
a. $(2, 1)$ *and* $(5, 6)$ — x_1, y_1 and x_2, y_2

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6-1}{5-2} = \frac{5}{3}$

b. $(-4, 1)$ *and* $(-2, -5)$ — x_1, y_1 and x_2, y_2

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5-1}{-2-(-4)} = \frac{-6}{2} = -3$

3. Determine the x-intercept and y-intercept of the linear equation with slope $m = -\frac{1}{3}$ going through the point $(3, -3)$. (2 marks)



$m = \frac{-1}{3} \rightarrow \frac{\text{down } 1}{\text{right } 3}$ or $\frac{\text{up } 1}{\text{left } 3}$

x – intercept: $(-6, 0)$

y – intercept: $(0, -2)$

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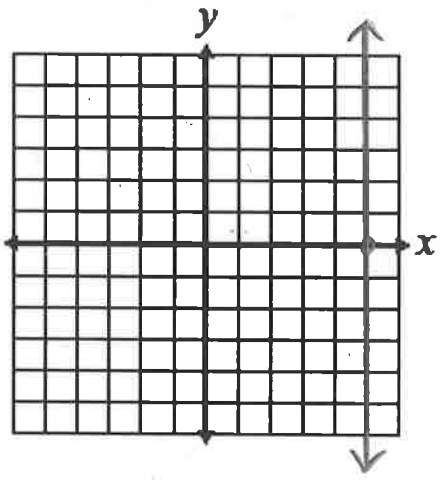
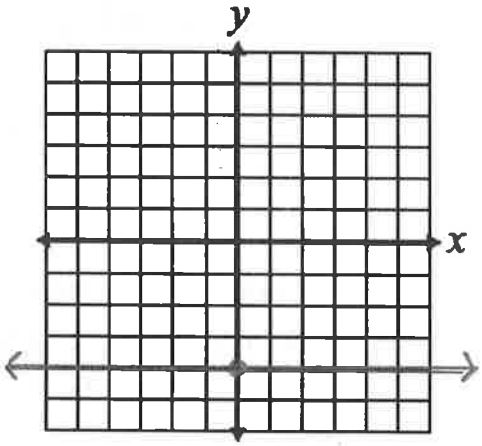
4. Draw a line with a slope of m = *undefined* that has a x-intercept of 5 (1 mark).

m = undefined → vertical line @ $x = 5$



5. Draw a line with a slope of $m = 0$ and has a y-intercept of -4 (1 mark).

m = 0 → horizontal line @ $y = -4$



6. Find a number n so that the line passing through the points $(n, 8)$ *and* $(-2, -4)$ has a slope of **3** (2 marks).

x_1, y_1 $\quad$ x_2, y_2

$$\frac{-4-8}{-2-n} = 3$$

$$\frac{-12}{-2-n} \times \frac{3}{1}$$

$$3(-2-n) = 1(-12)$$

$$-6 - 3n = -12 \quad (+6)$$

$$-3n = -6 \quad (\div -3)$$

$$n = 2$$

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

7. Determine whether Line 1, passing through the first pair of points, is **parallel, perpendicular** or **neither** to Line 2, passing through the second pair of points (3 marks):

Line 1 through $(4, -1)$ and $(6, 2)$, Line 2 through $(-6, -6)$ and $(4, 9)$

$x_1\ y_1$ $x_2\ y_2$ $x_1\ y_1$ $x_2\ y_2$

$m_1 = \frac{2 - (-1)}{6 - 4} = \frac{3}{2}$

$m_2 = \frac{9 - (-6)}{4 - (-6)} = \frac{15}{10} = \frac{3}{2}$

slopes are equal, so ℓ_1 is parallel to ℓ_2

8. Find the slope of a line that is **perpendicular** to a line that passes through $(-5, 1)$ and $(4, -2)$ (2 marks).

$x_1\ y_1$ $x_2\ y_2$

$m = \frac{-2 - 1}{4 - (-5)} = \frac{-3}{9} = \frac{-1}{3}$

flip AND change sign → slope of perpendicular line → 3

Slope of perpendicular line is 3

9. Show that the points A(1 ,3) , B(4, −3) and C(0, −5) are vertices of a right triangle. (3 marks)

∠B most likely to be 90°!

show that AB ⊥ to BC

M of AB: A(1, 3) B(4, −3)

$x_1\ y_1$ $x_2\ y_2$

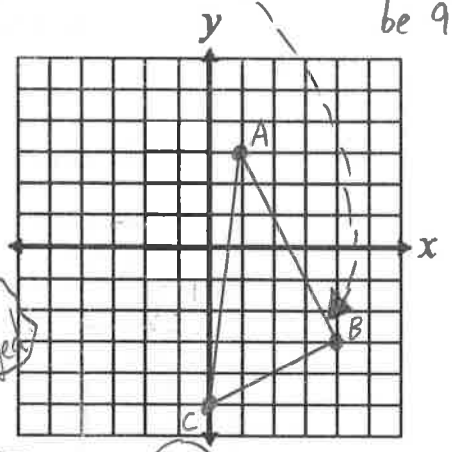
$\frac{y_2 - y_1}{x_2 - x_1} = \frac{-3 - 3}{4 - 1} = \frac{-6}{3} = -2$

M of BC: B(4, −3) C(0, −5)

$x_1\ y_1$ $x_2\ y_2$

$\frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - (-3)}{0 - 4} = \frac{-2}{-4} = \frac{1}{2}$

flipped, AND sign changed



−2 and $\frac{1}{2}$ are neg. reciprocals,

∴ AB ⊥ BC,

∴ ∠B is 90°,

∴ ΔABC is a right triangle!

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10. The line through $(-6, y)$ and $(2, -5)$ is **parallel** to a line with slope $\frac{-5}{4}$.

Find the value of y. (2 marks)

$x_1\ y_1$ $x_2\ y_2$ → equal slopes!

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

so... $\frac{-5-y}{2-(-6)} = \frac{-5}{4}$

cross multiply when: 1 fraction = 1 fraction

$\frac{-5-y}{8} \times \frac{-5}{4}$

$4(-5-y) = -5(8)$

$-20 - 4y = -40$

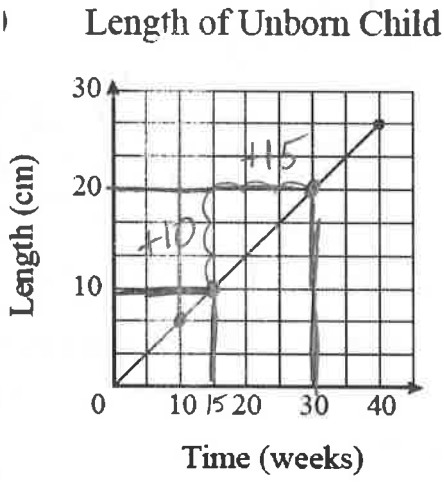
$+20 \quad +20$

$\frac{-4y}{-4} = \frac{-20}{-4}$

$y = 5$

11. Given the following graphs, determine the **rate of change**: (2 marks each)

a.



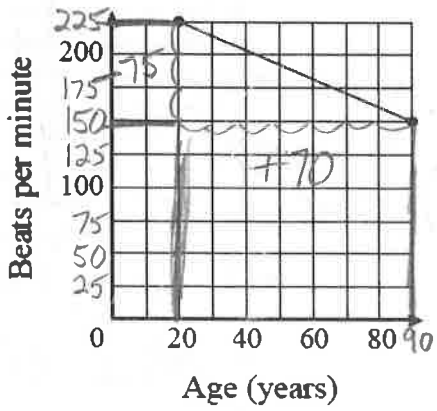
reduce!

Rate of change: $\frac{\Delta y}{\Delta x} = \frac{\Delta \text{length}}{\Delta \text{weeks}} = \frac{+10\text{cm}}{+15\text{weeks}} \begin{matrix} \div 5 \\ \div 5 \end{matrix}$

$= \frac{2}{3}\ \text{cm/week}$

or $0.\overline{6}\ \text{cm/week}$

b.



reduce!

Rate of change: $= \frac{\Delta \text{beats per min}}{\Delta \text{years}} = \frac{-75\ \text{bpm}}{70\ \text{years}} \begin{matrix} \div 5 \\ \div 5 \end{matrix}$

$= \frac{-15}{14}\ \text{beats per min/year}$

or $-1.07\ \text{beats per min/year}$

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x_1 y_1 y_2

12. A **3 year old** car is worth $24750, and will be worth $4650 when it is **18 years old.** (* Assume relationship is LINEAR)

x_2

a. Write the equation that shows the **V**alue of the car (***V***) depends on the **d**epreciation *rate* (**d**), the **n**umber of years old it is (***n***), and the value of the car when it was new, or the initial value (**i**) (1 mark)

dep. var. = rate of change x ind. var. + initial value

$$V = dn + i$$

b. Find the yearly depreciation of the car (rate of change). (1 mark)

$$d = \frac{\Delta \text{value}}{\Delta \text{years}} = \frac{4650 - 24750}{18 - 3} = \frac{-20100}{15} = \$-1340/\text{year}$$

car loses $1340 of value each year

c. Find the price of the car when it was new (the initial value, or *i*). (1 mark)

now, $V = -1340n + i$

* use either point to find i we'll use $(3, 24750)$ (n, V)

Sub. in values → $24750 = -1340(3) + i$

solve for i → $24750 = -4020 + i$

$+4020 \quad +4020$

$28770 = i$

The price of the car was $28770 when it was new!

d) What is linear equation that describes this relation, and

d. What is the Value of the car when it is 11 years old. (1 mark)

linear equation

$V = -1340n + 28770$

$V = -1340n + 28770$

$V = -1340(11) + 28770$

$V = -14740 + 28770$

$V = \$14030$

Value of car is $14030 when it's 11 yrs old

e. After how many years will the cars' value be $19,390? (1 mark)

$V = -1340n + 28770$

$19390 = -1340n + 28770$

$-28770 \quad -28770$

$\frac{-9380}{-1340} = \frac{-1340n}{-1340} \rightarrow n = 7$

The car will be 7 years old when it's worth $19,390