Day 1 Practice Problems – Solutions

① a) $2x - 4 = 3x + 12$

$+4 \quad +4$

$2x = 3x + 16$

$-3x \quad -3x$

$\frac{-x}{-1} = \frac{16}{-1}$

$\boxed{x = -16}$

b) $-6ax + 2b = 5ax - 5c$

$+6ax \quad +6ax$

$2b = 11ax - 5c$

$+5c \quad +5c$

$\frac{2b+5c}{11a} = \frac{11ax}{11a}$

$\boxed{x = \frac{2b+5c}{11a}}$

② a) $(x+2)(3x+4) = 3x^2 + 4x + 6x + 8$

$\boxed{= 3x^2 + 10x + 8}$

b) $(x^2 - 2y)(x + y^3) = x^3 + x^2y^3 - 2xy - 2y^4$

$\boxed{= x^3 - 2xy + x^2y^3 - 2y^4}$

c) $(x-1)(5-x^2) = \boxed{5x - x^3 - 5 + x^2}$

③ a) $2 - 4[6(4-1) - 20]$

$= 2 - 4[6(3) - 20]$

$= 2 - 4[18 - 20]$

$= 2 - 4(-2) = 2 + 8$

$\boxed{= 10}$

b) $5 - [2 + (1+1)^2]$

$= 5 - [2 + (2)^2]$

$= 5 - [2 + 4]$

$= 5 - 6 = \boxed{-1}$

④ a) $(5, 3)$ and $(1, -6)$

$m = \frac{-6-3}{1-5} = \frac{-9}{-4} = \boxed{\frac{9}{4}}$

b) $(-3.5, 2)$ and $(0, 4)$

$m = \frac{(4-2)}{0-(-3.5)} = \frac{2}{3.5} = \boxed{\frac{4}{7}}$

c) $(2a, 4)$ and $(5a, 10)$

$m = \frac{(10-4)}{(5a-2a)} = \frac{6}{3a} = \boxed{\frac{2}{a}}$

d) $(x+3b, -2)$ and $(2x-b, 1)$

$m = \frac{1-(-2)}{(2x-b-(x+3b)} = \boxed{\frac{3}{x-4b}}$

⑤ a) y-intercept ~ 1 lb.

slope: pt 1 = (0, 1)

pt 2 = (12, 325)

$$m = \frac{325 - 1}{12 - 0} = \frac{324 \text{ lbs}}{12 \text{ mo}} = \boxed{27 \frac{\text{lbs}}{\text{mo}}}$$

b) on average, a direwolf's weight will increase by an estimated 27 lbs/mo during the first year of its life.

⑥ $\frac{df}{dx} = \frac{f(x+\Delta x) - f(x)}{\Delta x}$ } take limit as $\Delta x \to 0$

a) $f(x) = 3x^2 + 2$

$$\frac{df}{dx} = \lim_{\Delta x \to 0} \frac{(3(x+\Delta x)^2 + 2) - (3x^2 + 2)}{\Delta x}$$

$$\frac{df}{dx} = \lim_{\Delta x \to 0} \frac{3(x^2 + 2x\Delta x + \Delta x^2) + 2 - 3x^2 - 2}{\Delta x}$$

$$\frac{df}{dx} = \lim_{\Delta x \to 0} \frac{3x^2 + 6x\Delta x + 3\Delta x^2 + 2 - 3x^2 - 2}{\Delta x}$$

$$\frac{df}{dx} = \lim_{\Delta x \to 0} \frac{\Delta x(6x + 3\Delta x)}{\Delta x}$$

$$\frac{df}{dx} = \lim_{\Delta x \to 0} 6x + 3\Delta x = \boxed{6x}$$

b) $f(x) = 4x$

$$\frac{df}{dx} = \lim_{\Delta x \to 0} \frac{4(x+\Delta x) - 4x}{\Delta x} = \lim_{\Delta x \to 0} \frac{4x + 4\Delta x - 4x}{\Delta x}$$

$$\frac{df}{dx} = \lim_{\Delta x \to 0} (4) = \boxed{4}$$

(7) $H = 2Y^2 + 1$

a) 2 must be $\left[\frac{\text{joules}}{yr^2}\right]$

1 must be [joules]

b) A newborn dragon (age = 0 years) can produce 1 joule of heat energy.

b) $\frac{df}{dx} = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$

$$\frac{dH}{dy} = \lim_{\Delta y \to 0} \frac{2(y+\Delta y)^2 + 1 - (2y^2+1)}{\Delta y}$$

$$= \lim_{\Delta y \to 0} \frac{2(y^2 + 2y\Delta y + \Delta y^2) + 1 - 2y^2 - 1}{\Delta y}$$

$$= \lim_{\Delta y \to 0} \frac{2y^2 + 4y\Delta y + 2\Delta y^2 + 1 - 2y^2 - 1}{\Delta y}$$

$$\frac{dH}{dy} = \lim_{\Delta y \to 0} \frac{4y\Delta y + 2\Delta y^2}{\Delta y}$$

$$= \lim_{\Delta y \to 0} \frac{\Delta y(4y + 2\Delta y)}{\Delta y}$$

$$= \lim_{\Delta y \to 0} (4y + 2\Delta y) = 4y = \frac{dH}{dy}$$

@ $y = 2.5$, $\frac{dH}{dy} = 4(2.5) = \boxed{10 \ \frac{\text{joules}}{yr}}$

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