

Math 80 Worksheet #3

1. Linear Equations:

- (a) Find an equation of a line with slope 4 that goes through the point $(3, 2)$.

Using the point-slope form of a line with $m = 4$, $x_1 = 3$, $y_1 = 2$, we have $y - 2 = 4(x - 3)$.

If we solve for y , we have the same linear equation in slope-intercept form: $y = 4x - 10$

- (b) Find an equation of a line perpendicular to the line in part (a) that intersects the y -axis when $y = 5$.

If the line is perpendicular to the line in part (a), then the line will have slope $-\frac{1}{4}$.

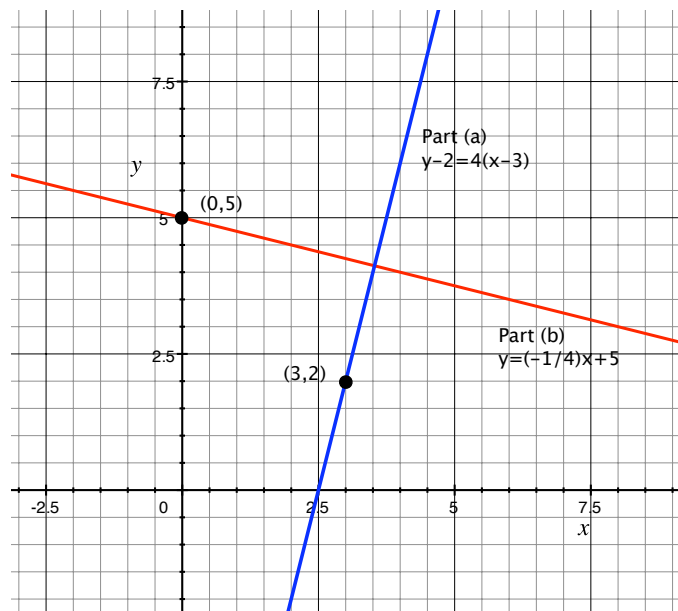
The point at which a line intersects the y -axis ($x = 0$) is the y -intercept so the line goes through the point $(0, 5)$.

Using the slope-intercept form of a line with $m = -\frac{1}{4}$, and $b = 5$, we have $y = -\frac{1}{4}x + 5$.

Note: You could also plug in the point $(0, 5)$ into the point-slope form

$$\rightarrow y - 5 = -\frac{1}{4}(x - 0).$$

- (c) Graph both lines on the same set of axes.



2. Exponential Expressions and Scientific Notation:

(a) Simplify and write the following with positive exponents only.

i. $(-3)^{-2}$

$$(-3)^{-2} = \frac{1}{(-3)^2} = \frac{1}{9}$$

ii. $(-8)^0 - 8^0$

$$(-8)^0 - 8^0 = 1 - 1 = 0$$

iii. $\frac{x^{-2}(5-3x)^6}{(5-3x)^3}$

$$\begin{aligned}\frac{x^{-2}(5-3x)^6}{(5-3x)^3} &= \frac{(5-3x)^6}{x^2(5-3x)^3} \quad (\text{Definition of negative exponents}) \\ &= \frac{(5-3x)^{6-3}}{x^2} \quad (\text{Quotient Rule}) \\ &= \frac{(5-3x)^3}{x^2}\end{aligned}$$

Note: $(5-3x)^6 \neq 5^6 - (3x)^6$. The power rule of exponents does not apply to sums or difference. It only applies to products.

In fact, $(5-3x)^6 = (5-3x)(5-3x)(5-3x)(5-3x)(5-3x)(5-3x)$.

iv. $\frac{(3p^{-4}q^3)^2}{(5p^2q^{-5})^{-3}}$

There are a couple ways to begin depending on which exponents rules you apply first. Here is one way to simplify this expression:

$$\begin{aligned}\frac{(3p^{-4}q^3)^2}{(5p^2q^{-5})^{-3}} &= \frac{3^2(p^{-4})^2(q^3)^2}{5^{-3}(p^2)^{-3}(q^{-5})^{-3}} \quad (\text{Power rule for products}) \\ &= \frac{3^2p^{-8}q^6}{5^{-3}p^{-6}q^{15}} \quad (\text{Power Rule \#1}) \\ &= 3^25^3p^{-8-(-6)}q^{6-15} \quad (\text{Definition of negative exponents and quotient rule}) \\ &= 9(125)p^{-2}q^{-9} \\ &= \frac{1125}{p^2q^9}\end{aligned}$$

3. Jupiter's average distance from the sun is approximately 7.8×10^8 kilometers and the speed of light is approximately 3.0×10^5 kilometers per second. Approximately how many seconds does it take for sunlight to reach Jupiter's surface?

Recall that distance = rate \times time ($d = rt$ or $t = \frac{d}{r}$).

So, the time it take for sunlight to reach Jupiter's surface is $t = \frac{7.8 \times 10^8}{3.0 \times 10^5}$

$$\begin{aligned} &= \frac{7.8}{3.0} \times \frac{10^8}{10^5} \\ &= 2.6 \times 10^3 \\ &= 2600 \text{ seconds} \end{aligned}$$

4. Simplify and write the following in scientific notation: $(2 \times 10^{-4}) \cdot (8 \times 10^6)$

$$\begin{aligned} (2 \times 10^{-4}) \cdot (8 \times 10^6) &= (2 \cdot 8) \times (10^{-4} \cdot 10^6) = 16 \times 10^2 = (1.6 \times 10^1) \times 10^2 \\ &= 1.6 \times 10^3 \end{aligned}$$