STATION A

1. Evaluate the following using exponent laws (write your final answer with positives exponents only).

a. $\left(\frac{2}{5}\right)^{-3}$

$= \left(\frac{5}{2}\right)^{3}$

$= \frac{125}{8}$

b. $\sqrt[5]{\frac{1}{32}}^{\,2}$

$= \left(\frac{1}{32}\right)^{\frac{2}{5}}$

$= \left(\frac{1}{2}\right)^{2}$

$= \frac{1}{4}$

c. $16^{\frac{3}{4}} + \sqrt[3]{8}$

$= \left(\sqrt[4]{16}\right)^{3} + 2$

$= 2^{3} + 2$

$= 8 + 2$

$= 10$

d. $\dfrac{2^{3} - 2^{-3}}{2^{2} \div 2^{4}}$

$= \dfrac{2^{3} - 2^{-3}}{2^{-2}}$

$= \dfrac{2^{3}}{2^{-2}} - \dfrac{2^{-3}}{2^{-2}}$

$= 2^{5} - 2^{-1}$

$= 32 - \frac{1}{2}$

$= 31\frac{1}{2}$

STATION B

1. Simplify the following using exponent laws (write your final answer with positives exponents only)

a. $\left(2^{x+1}\right)\left(4^{x+1}\right)\left(8^{x+1}\right) \div 64^{x}$

$= 2^{x+1} \cdot (2^2)^{x+1} \cdot (2^3)^{x+1} \div (2^6)^x$

$= 2^{x+1} \cdot 2^{2x+2} \cdot 2^{3x+3} \div 2^{6x}$

$= 2^{6x+6} \div 2^{6x}$

$= 2^6$

$= 64$

b. $\sqrt{\dfrac{x^3}{\sqrt{x}}}$

$= \left(\dfrac{x^3}{x^{\frac{1}{2}}}\right)^{\frac{1}{2}}$

$= \dfrac{x^{\frac{3}{2}}}{x^{\frac{1}{4}}}$

$= x^{\frac{3}{2} - \frac{1}{4}}$

$= x^{\frac{6}{4} - \frac{1}{4}}$

$= x^{\frac{5}{4}}$

c) $\left(\dfrac{3x^2}{y^{-1}}\right)^{-2}\left(\dfrac{2y^2}{3x}\right)^{3}$

$= \left(\dfrac{y^{-1}}{3x^2}\right)^2 \left(\dfrac{2^3 y^6}{3^3 x^3}\right)$

$= \left(\dfrac{y^{-2}}{9x^4}\right)\left(\dfrac{8y^6}{27x^3}\right)$

$= \dfrac{8y^4}{243x^7}$

d) $\left(\dfrac{9a^3b^{-5}c^2}{ab^{-1}}\right)^{-\frac{1}{2}} \div \left(\dfrac{b^3c}{2a}\right)^{3}$

$= (9a^2b^{-4}c^2)^{-\frac{1}{2}} \div \dfrac{b^9c^3}{8a^3}$

$= 9^{-\frac{1}{2}}a^{-1}b^2c^{-1} \times \dfrac{8a^3}{b^9c^3}$

$= \dfrac{8a^2}{9^{\frac{1}{2}}b^7c^4}$

$= \dfrac{8a^2}{3b^7c^4}$

STATION C

1. Solve the following using the exponent rules.

$3^{x-1} = 27^{2x+3}$ $\quad 81^{x+3} = 9\sqrt{3}$ $\quad 3^{x+2} + 3^{x} = 270$

$3^{x-1} = (3^3)^{2x+3}$

$3^{x-1} = 3^{6x+9}$

$x-1 = 6x+9$

$-10 = 5x$

$-2 = x$

$x = -2$

$(3^4)^{x+3} = 3^2 \cdot 3^{\frac{1}{2}}$

$3^{4x+12} = 3^{\frac{5}{2}}$

$4x+12 = \frac{5}{2}$

$4x = \frac{5}{2} - 12$

$4x = \frac{5}{2} - \frac{24}{2}$

$4x = \frac{-19}{2}$

$x = \frac{-19}{2} \div 4$

$= \frac{-19}{2} \times \frac{1}{4}$

$= \frac{-19}{8}$

$3^x(3^2+1) = 270$

$\frac{3^x(10)}{10} = \frac{270}{10}$

$3^x = 27$

$3^x = 3^3$

$x = 3$

STATION D

1. HCG, a chemical found in pregnant women, doubles every 55 hours for the first three months of pregnancy. The level of HCG is 5 mIU/ml in a women that is 3 weeks pregnant. How much HCG is there in her blood when she is 11 weeks pregnant?

2. Thorium-227 has a half-life of 18.4 days. How much time will a 50-mg sample take to decompose to 12.5 mg?

① $A = a_0 (b)^x$

$= 5(2)^{\frac{1344}{55}}$

$\doteq 113{,}513{,}742.9 \ \frac{mLU}{mL}$

Given

$a_0 = 5$

$b = 2$

$x = \frac{t}{55}$

$t = 8 \times 24 \times 7$

$= 1344$

11 weeks − 3 weeks

= 8 weeks

②

Given

$a_0 = 50$

$A = 12.5$

$b = \frac{1}{2}$

$h = 18.4$

$x = \frac{t}{h}$

$A = a_0 (b)^x$

$12.5 = 50\left(\frac{1}{2}\right)^{\frac{t}{h}}$

$\frac{12.5}{50} = \left(\frac{1}{2}\right)^{\frac{t}{18.4}}$

$\frac{1}{4} = \left(\frac{1}{2}\right)^{\frac{t}{18.4}}$

$\left(\frac{1}{2}\right)^2 = \left(\frac{1}{2}\right)^{\frac{t}{18.4}}$

$2 = \frac{t}{18.4}$

$36.8 = t$

∴ It will take 36.8 days

STATION E

1.

Relation	Domain	Range
$y = 3^{x+2} - 1$	$\{x \in \mathbb{R}\}$	$\{y \in \mathbb{R}, y > 1\}$

2. Complete the table.

Original Function	Equation of Transformed Function	Transformations (in order)
$y = 2^x$	$y = 7(2)^{-(x+3)} - 5$	• Reflection in the y-axis • Vertical stretch by a factor of 7 • Horizontal translation left 3 • Vertical translation down 5

3. Given the exponential function $f(x) = 30\,(2)^{3x} + 5$

1. The equation of the asymptote $y = 5$
2. The y-int or original amount 35
3. The transformations occurring:

Base $y = 2^x$

① vertical stretch by 30

② Horizontal compression by 3

③ shift up 5

STATION F

Annika was working with an expression of the form (something)$^{-3}$. Partway down the page you see this $\frac{2(x^2y)^{12}}{125x}$. What expression could she have been working with?

$$= \frac{\left(2^{\frac{1}{3}}(x^2y)^4\right)^3}{(5x^{\frac{1}{3}})^3}$$

$$= \left(\frac{5x^{\frac{1}{3}}}{2^{\frac{1}{3}}(x^2y)^4}\right)^{-3}$$

STATION G

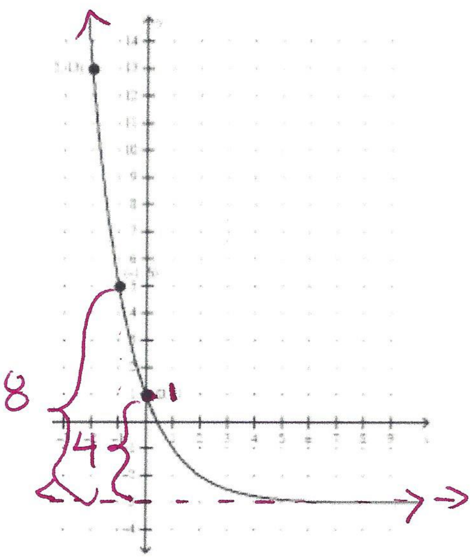
1. State the domain and range and find an equation for the exponential equation.

$D = \{x \in \mathbb{R}\}$

$R = \{y \in \mathbb{R}, y > -3\}$

$f(x) = 4\left(\frac{1}{2}\right)^x - 3$

decreasing



2. Graph each of the following:

Base $y = 2^x$

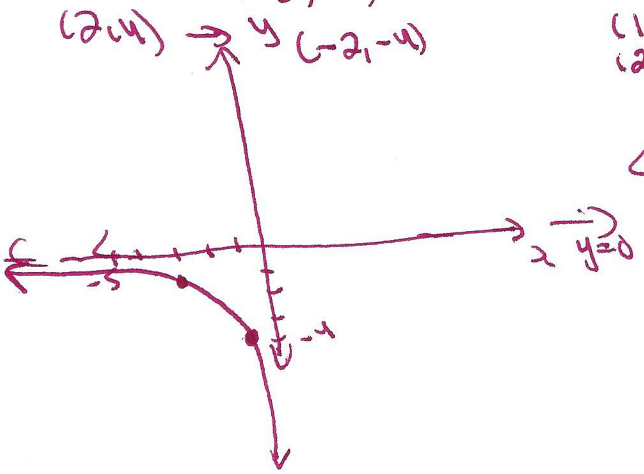
a) $f(x) = -\,2^{2x+6}$

$= -2^{2(x+3)}$

$(x,y) \to \left(\frac{x}{2} - 3, -y\right)$

$(0,1) \to (-3,-1)$

$(2,4) \to (-2,-4)$



Base $y = \left(\frac{1}{3}\right)^x$ or $\boxed{y = 3^x}$

b) $f(x) = \left(\frac{1}{3}\right)^{2x}$

$\boxed{f(x) = 3^{-2x}}$

① H.C by 2

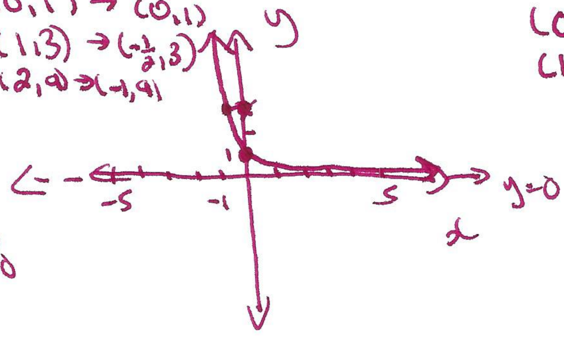
② reflect in y

$(x,y) \to \left(\frac{-x}{2}, y\right)$

$(0,1) \to (0,1)$

$(1,3) \to \left(-\frac{1}{2}, 3\right)$

$(2,9) \to (-1,9)$



Base $y = 5^x$

c) $f(x) = -3(5)^{-x}$

① reflect x axis

② V.S by 3

③ reflect y

$(x,y) \to (-x, -3y)$

$(0,1) \to (0,-3)$

$(1,5) \to (-1,-15)$