1. Evaluate the following expressions, leave your answers in fraction form where applicable.

a) $\left(4^2\right)^4$ b) $2^6 \times 2^{-4} \div 2^{-3}$ c) $(-32)^{\frac{1}{5}}$ d) $\left(\frac{8}{27}\right)^{-\frac{4}{3}}$

2. Write a simplified equivalent expression using exponents (one exponent only on your answer). (2 marks)

a) $\sqrt{\sqrt{x^{12}}}$ b) $\sqrt[3]{\sqrt{5x^8}}$

3. Simplify. Express each answer with **positive** exponents.

a) $\left(3x^{-2}y^2\right)\left(-2x^2y^{-3}\right)$ b) $\frac{\left(4m^2n^4\right)\left(7m^3n\right)}{14mn^5}$ c) $\left(\frac{3a^2b^3}{2a^{-3}b}\right)^{-3}$

4. Solve the following expressions for x.

a) $81 = 3^x$ b) $4^{3x} = 64$ c) $2^{x+5} = 8^{x+1}$ d) $8^{x+3} = 16^{2x+1}$

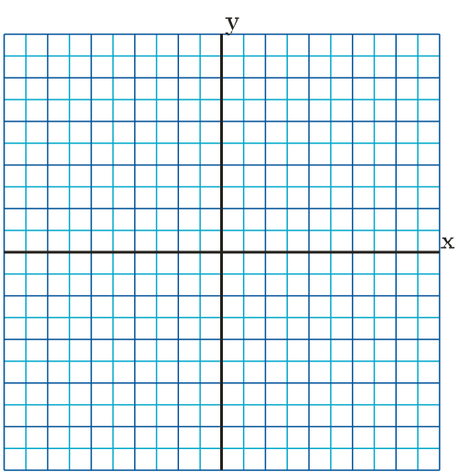
5. For each of the following;

i) State any transformations that have been made to $y = a^x$

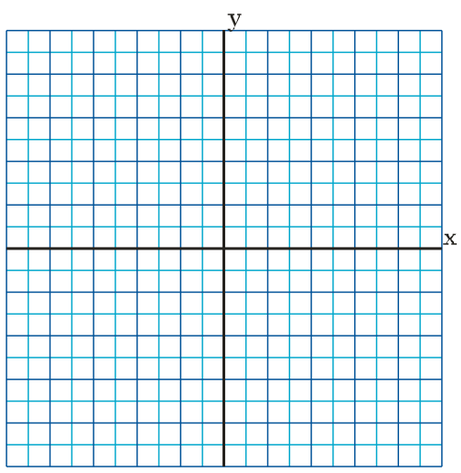
ii) Make a sketch of the transformed function, include the y intercept and horizontal asymptote.

iii) State the domain and range

a) $y = -2^{x+4} + 5$



b) $y = 5\left(\frac{1}{2}\right)^x - 8$



6. Match the equation to the appropriate graph for the following functions:

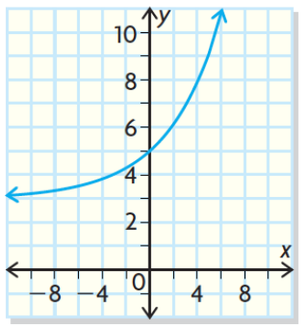
a) $f(x) = -\left(\frac{1}{4}\right)^{-x} + 3$

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

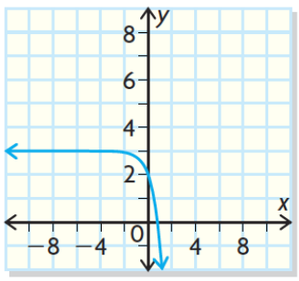
c) $g(x) = -\left(\frac{5}{4}\right)^{-x} + 3$

d) $h(x) = 2\left(\frac{5}{4}\right)^{x} + 3$

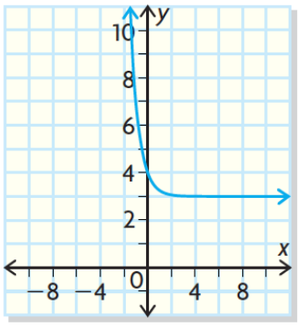
i)



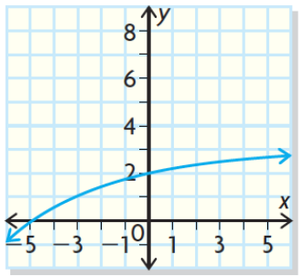
iii)



ii)



iv)



Match answers go here:

a) _____ b) _____ c) _____ d) _____

7. The world population in 2016 was approximately 7.2 billion. The population has been increasing at a rate of 1.8% per year.

a) Write an equation to represent the world population after x number of years.
b) What would the population be in 2025?
c) How many people will be added between 2018 and 2019? Answer in millions of people please.

8. A laboratory has a 750g sample of uranium. This substance has a half life of 20 years.
a) Write an equation to represent the mass of the substance after x half-lives.
b) How much of the sample is left after 120 years?
c) How many years will it take before the sample is 187.5g in size?