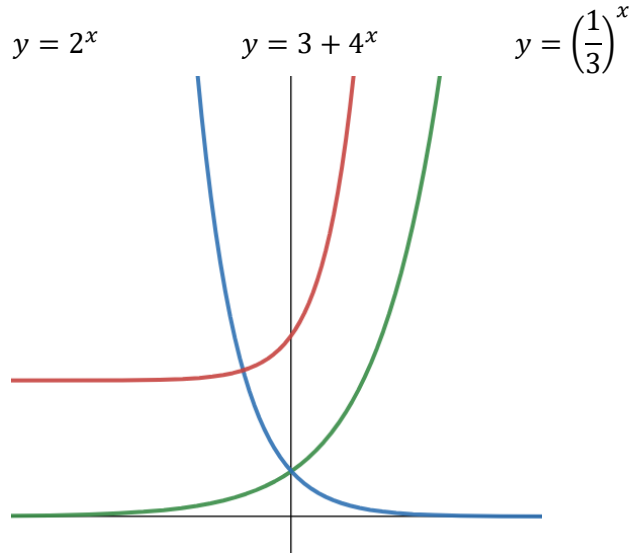


Exponential Graphs and Models—www.m4ths.com

(1) (a) Match each graph with their equation:



(b) Write down the coordinates of the point where each graph above crosses the y axis.

(c) Draw the horizontal asymptote on the diagram above for the graph $y = 3 + 4^x$

(d) Explain why the graph of $y = 3^{-x}$ and $y = \left(\frac{1}{3}\right)^x$ are identical.

(2) **Sketch** the graph of $y = 4^x$ on a new set of coordinate axes. Show where the graph crosses the y axis.

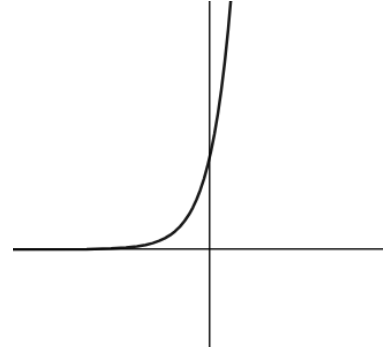
(b) Hence, sketch the graph of $y = 4^x - 3$ on the same set of axes showing where the graph crosses the y axis showing the horizontal asymptote.

(3) Explain why the formula $P = 300 + 2x$ does not model an exponential function.

(4) (a) Explain why $P = 300 \times 2^{-3x}$ is an exponential model.

(b) Does the model show growth or decay?

(5) The diagram shows part of the graph with equation $y = a \times b^x$. The graph has the points $A(1,12)$ and $B(3,108)$.



(a) Find the values of a and b .
 (b) Find the coordinates of the point where the graph crosses the y axis.

(6) Fred invests £900 in a bank paying compound interest of 1.8% a year.

- (a) Write an exponential model for the amount of money M Fred has in his account after n years.
 (b) Find out how much money he has in his account at the end of the 5th year.
 (c)* Find out how long it will take him to have more than £2000 in his account.
 (d) Sketch the graph of M against n .

(7) A drug is administered to a patient in an attempt to sedate them. A dose of 300mg is given at midday. The amount of the drug in the blood stream reduces by 8% an hour.

- (a) Write an exponential model for the amount of the drug M in the bloodstream t hours after midday.
 (b) Find out how much of the drug is still present at 6pm.

(c)* Find out how many hours it will take for the amount of the drug left in the system to be less than 5mg.

(d) Sketch a graph to show the model.

(8) $f(x) = 4^x$

(a) Sketch the graph of $y = f(x)$ showing where the graph crosses the coordinate axes.

(b) Sketch the graph of $y = f(x) + 5$ showing where the graph crosses the coordinate axes and writing down the equation of the asymptote.

(c) Sketch the graph of $y = -f(x)$ showing where the graph crosses the coordinate axes.

(9) A colony of roadmen is being observed. The population P after n days can be modelled by the equation

$$P = 500000(0.8^n)$$

- (a) How many roadmen were there at the start of the observation?
 (b) Are the roadies increasing or decreasing? You must explain why.
 (c) Find the number of roadies after 2 weeks.
 (d)* Find out how many days it will take until there less than 250 roadmen.
 (e) Sketch the graph of the model labelling the axes.
 (f) Why is this model pleasing to society?

(10)* Solve each equation:

(a) $300 = 1.4^x$ (b) $520 = 0.3^{5x}$

(11)** Solve the inequality $0.8 > 1.9^x$

(12)*** **Without a calculator**, find $\log_5 \frac{1}{25}$. You **MUST** explain your answer fully.