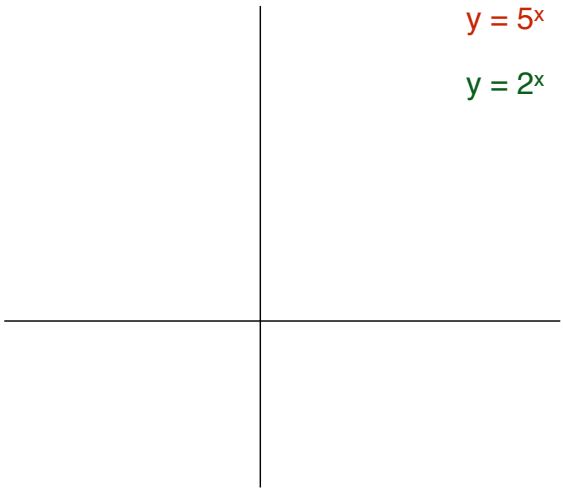
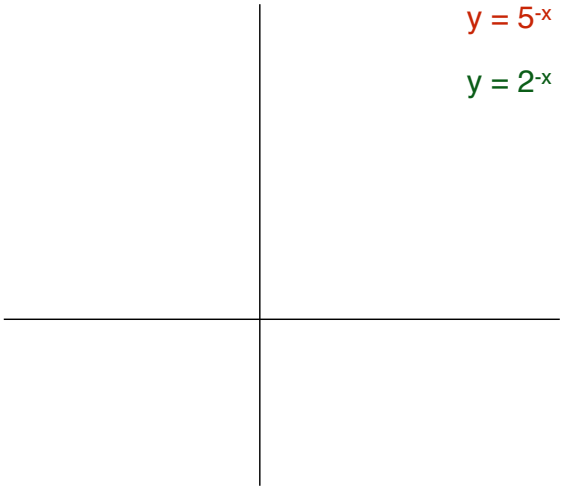
Exponential

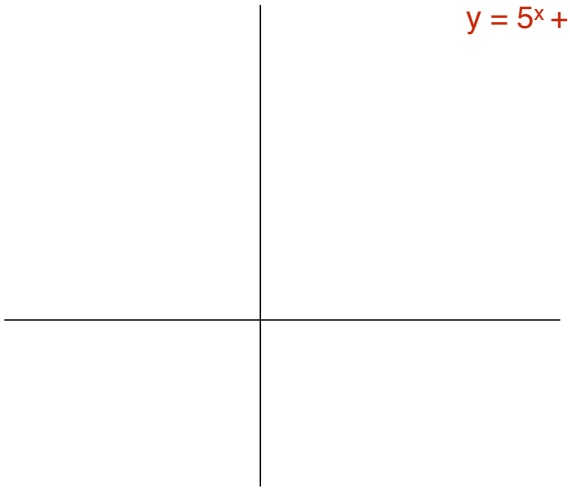
Exponential graph

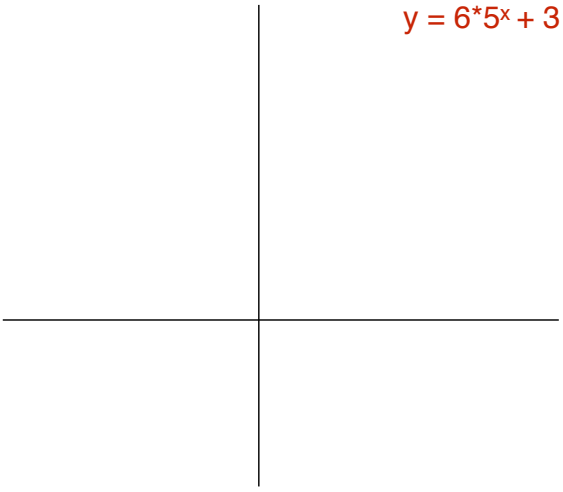




Exponential

Exponential graph





Exponential

1. Using your calculator, sketch the following functions on the same set of axes, for $-5 \le x \le 5$ and $0 \le y \le 10$. Show all the axis intercepts and state the equation of the horizontal asymptote.

(a) (i) $y = 1.5^x$ (ii) $y = 3^x$

Exponential

1. Using your calculator, sketch the following functions on the same set of axes, for $-5 \le x \le 5$ and $0 \le y \le 10$. Show all the axis intercepts and state the equation of the horizontal asymptote.

(b) (i) $y = 2 \times 3^x$ (ii) $y = 6 \times 1.4^x$

Exponential

1. Using your calculator, sketch the following functions on the same set of axes, for $-5 \le x \le 5$ and $0 \le y \le 10$. Show all the axis intercepts and state the equation of the horizontal asymptote.

(d) (i) $y = 5 + 2^x$ (ii) $y = 8 + 3^x$

Exponential

$$N = Ba^{\left(\frac{t}{k}\right)} + c$$

In this case, B represents how much N starts above the background level, so the initial value is $B + c$.

For $N = Ba^{\left(\frac{t}{k}\right)} + c$:

- the background level is c (i.e. the asymptote is $N = c$)
- the initial value is $B + c$
- k is the time taken for the difference between N and the background level to increase by a factor of a
- if $a > 1$ the function models exponential growth
- if $0 < a < 1$ the function models exponential decay.

The temperature T, in degrees Celsius, of a cooling liquid is modelled by the equation $T = 24 + 72 \times 0.6^{3t}$, where t is the time in minutes after the cooling begins.

(a) What was the initial temperature of the liquid?

(b) Find the temperature of the liquid after 2 minutes.

(c) How long does it take for the liquid to cool to 26°C?

(d) What temperature does the model predict the liquid will eventually reach?

A population of bacteria in a culture medium doubles in size every 15 minutes. At 08:00 there are 1000 bacterial cells. Let N be the number of bacterial cells t hours after 08:00.

(a) Write down a model for N in terms of t.

(b) How many cells are there at

(i) 08:15?

(ii) 09:24?

6. The speed V (in metres per second) of a parachutist t seconds after jumping from an aeroplane is modelled by the equation

$$V = 40(1 - 3^{\,0.1t})$$

(a) Find the parachutist's initial speed.

(b) What speed does the model predict that the parachutist will approach eventually? *[6 marks]*

7. The air temperature T (in degrees Celsius) around a light bulb is given by the equation

$$T = A + B \times 2^{-\frac{x}{k}}$$

where x is the distance in millimetres from the surface of the light bulb. The background temperature in the room is a constant 25°C, and the temperature on the surface of the light bulb is 125°C.

(a) Suppose that the air temperature 3 mm from the surface of the bulb is 75°C. Find the values of A, B and k.

(b) Determine the air temperature 2 cm from the surface of the bulb.

(c) Sketch a graph of air temperature against distance from the surface of the bulb. *[10 marks]*