1. A cup of coffee cools according to the formula $P_t = P_0 e^{-kt}$, where P_0 is the initial temperature of the coffee and P_t is the temperature after t minutes.

    (a) A cup of coffee cools from 80°C to 60°C in a time of 15 minutes. Calculate k. **(3)**

    (b) By how many degrees will the cup of coffee cool in the following 15 minutes? **(3)**

2. A fire spreads according to the formula $A = A_0 e^{kt}$, where A_0 is the area covered by the fire when it is first measured ad A is the area covered after t hours.

    (a) If it takes $1\frac{1}{2}$ hrs for the fire to double in area, find k. **(3)**

    (b) A bush fire covers an area of 800km^2. If not tackled, calculate the area the fire will cover 4 hours later. **(2)**

3. The value V(£ million), of a container ship is given by the formula $V = 120e^{-0.065t}$, where t is the number of years after the ship is launched.
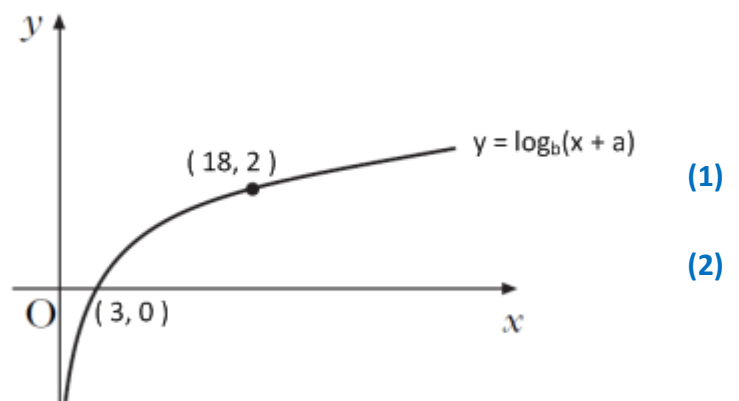
    (a) Calculate the value of the ship when it is launched. **(2)**

    (b) Calculate the percentage reduction in value of the ship after 6 years. **(3)**

4. The diagram opposite shows the graph of $y = \log_b(x + a)$

    (a) Find the value of a **(1)**
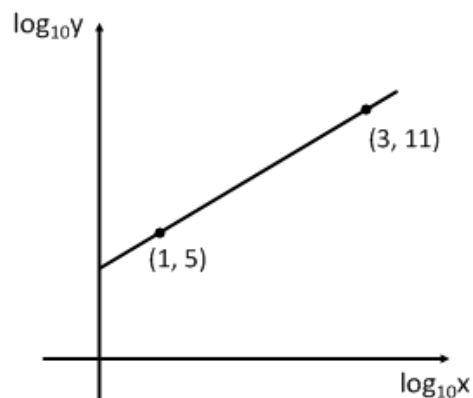
    (b) Find the value of b **(2)**

5. Two variables, x and y, are related by the equation

$$y = kx^n$$

When $\log_{10}y$ is plotted against $\log_{10}x$, a straight line passing through the points (1, 5) and (3, 11) is obtained, as shown in the diagram.
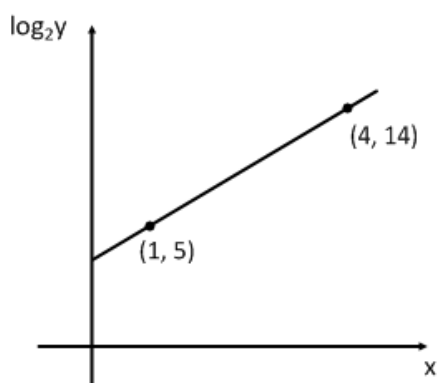
Find the values of k and n.

(5)

$\log_{10}y$ vertical axis, $\log_{10}x$ horizontal axis, line through (1, 5) and (3, 11)

6. Two variables, x and y, are related by the equation

$$y = ab^x$$

When $\log_2 y$ is plotted against x, a straight line passing through the points (1, 5) and (4, 14) is obtained, as shown in the diagram.

Find the values of a and b.

(5)

$\log_2 y$ vertical axis, x horizontal axis, line through (1, 5) and (4, 14)