## LOGARITHMIC FUNCTION

1. Sketch these graphs. Find their intersections with the x-axis and the y-axis, if possible, their domains, ranges and asymptotes:

   a) $y = log_2 x$

   b) $y = -log_2 x$

   c) $y = log_{1/2} x$

   d) $y = log_2 x + 2$

   e) $y = log_2 (x + 1)$

   f) $y = 3 log_2 x$

2. Use the logarithmic definition to work out the value of x:

   a) $log_2 x = 3$

   b) $log_3 9 = x$

   c) $log_{1/2} x = -1$

   d) $log_2 x = -3$

   e) $log_x 16 = 4$

   f) $log_{1/3} 1 = x$

   g) $log_x \dfrac{1}{25} = -2$

   h) $log_3 x = 3$

   i) $log_2 x = -4$
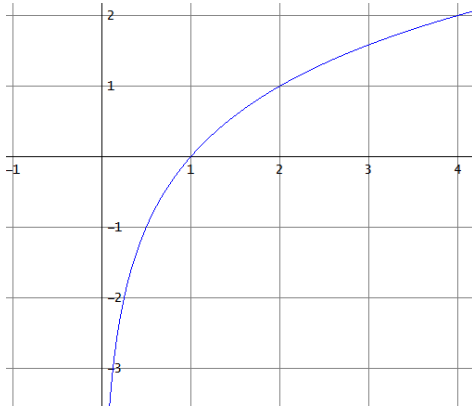
   j) $log_5 125 = x$

   k) $log\ 1000000 = x$

SOLUTION

3. Sketch these graphs. Find their intersections with the x-axis and the y-axis, if possible, their domains, ranges and asymptotes:

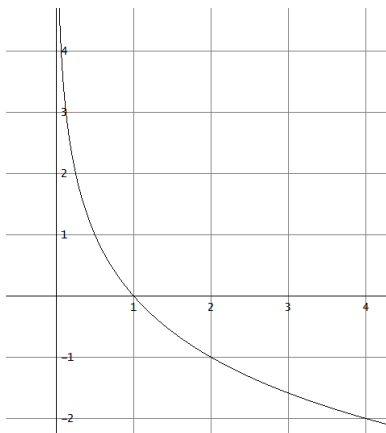a) $y = log_2 x$                                intersection with x-axis (1,0)

Domain $D = (0,+\infty)$

Range $R = (-\infty,+\infty)$

Vertical asymptote $x = 0$

b) $y = -log_2 x$                                intersection with x-axis (1,0)

Domain $D = (0,+\infty)$

Range $R = (-\infty,+\infty)$

Vertical asymptote $x = 0$

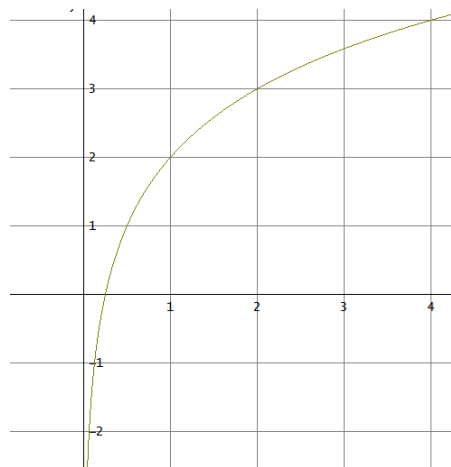c) $y = log_{1/2} x$ (the same as b))

d) $y = log_2 x + 2$

intersection with x-axis $\left(\dfrac{1}{4},0\right)$

Domain $D = (0,+\infty)$

Range $R = (-\infty,+\infty)$

Vertical asymptote $x = 0$

The graph is the same as $y = log_2 x$ up the y-axis by the value of 2

e)  $y = log_2(x+1)$
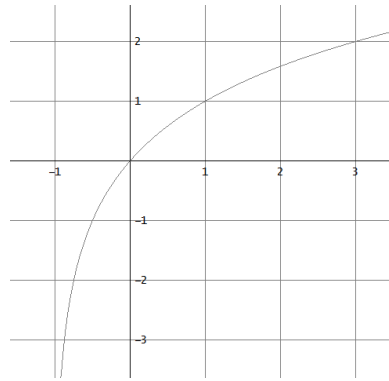
intersection with axis $(0,0)$

Domain $D = (0,+\infty)$

Range  $R = (-\infty,+\infty)$

Vertical asymptote $x = -1$

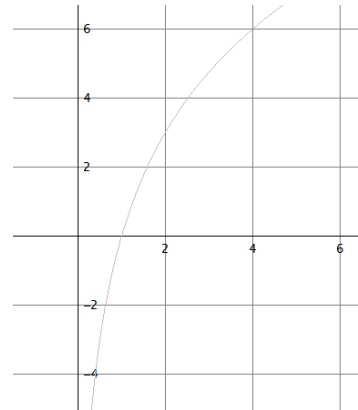The graph is the same
as $y = log_2 x$ 1 unit to the left

f)  $y = 3\,log_2 x$

intersection with x-axis $(1,0)$

Domain $D = (0,+\infty)$

Range  $R = (-\infty,+\infty)$

Vertical asymptote $x = 0$

4.  Use the logarithmic definition to work out the value of x:

a)  $log_2 x = 3 \Leftrightarrow 2^3 = x \Rightarrow x = 8$

b)  $log_3 9 = x \Leftrightarrow 3^x = 9 \Rightarrow x = 2$

c)  $log_{1/2} x = -1 \Leftrightarrow \left(\dfrac{1}{2}\right)^{-1} = x \Rightarrow 2^1 = x \Rightarrow x = 2$

d)  $log_2 x = -3 \Leftrightarrow 2^{-3} = x \Rightarrow \dfrac{1}{2^3} = x \Rightarrow x = \dfrac{1}{8}$

e)  $log_x 16 = 4 \Leftrightarrow x^4 = 16 \Rightarrow x^4 = 2^4 \Rightarrow x = 2$

f)  $log_{1/3} 1 = x \Leftrightarrow \left(\dfrac{1}{3}\right)^x = 1 \Rightarrow x = 0$

g)  $log_x \dfrac{1}{25} = -2 \Rightarrow x^{-2} = \dfrac{1}{25} \Rightarrow \dfrac{1}{x^2} = \dfrac{1}{25} \Rightarrow x = 5$

h)  $log_3 x = 3 \Leftrightarrow 3^3 = x \Rightarrow x = 27$

i)  $log_2 x = -4 \Leftrightarrow 2^{-4} = x \Rightarrow x = \dfrac{1}{16}$

j)  $log_5 125 = x \Leftrightarrow 5^x = 125 \Rightarrow x = 3$

k)  $log\, 1000000 = x \Leftrightarrow 10^x = 1000000 \Rightarrow x = 6$