Foundation stage 1:

1. Use the change of base formula $\log_a x = \dfrac{\log_{10} x}{\log_{10} a}$ to evaluate the following logarithms, correct to 3 significant figures.

   (a) $\log_3 5$

   (b) $\log_3 0.5$

   (c) $\log_{0.2} 7$

   (d) $\log_{1.2} 0.9$

2. Solve the following equations by using logarithms, correct to 3 significant figures:

   (a) $3^x = 15$

   (b) $3^x = 1.5$

   (c) $4^x = 0.15$

   (d) $40^x = 0.5$

   (e) $0.5^x = 0.05$

   (f) $0.007^x = 1.234$

3. Without using a calculator to find the exact solution of the following inequalities involving logarithms with base number more than 1:

   (a) $2^x > 8$

   (b) $2^x \le 8$

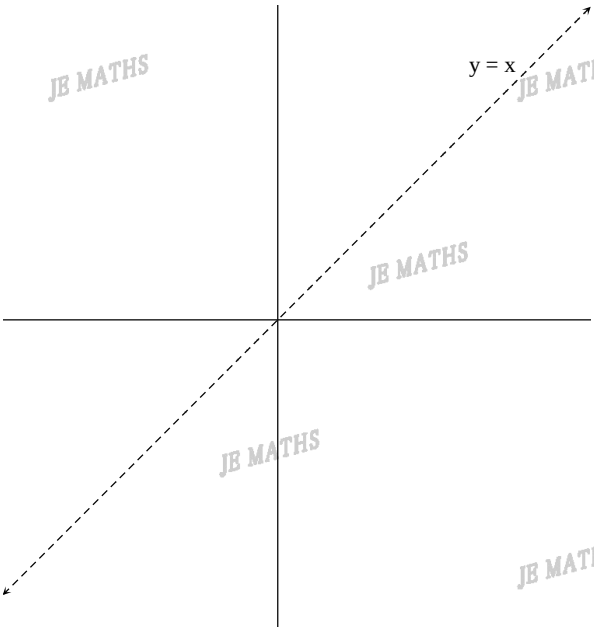
   (c) $3^x > \dfrac{1}{9}$

   (d) $10^x \le 0.001$

Foundation stage 2:

1. (a) Sketch $y = 3^x$ and $y = \log_3 x$ by using the symmetry property of the inverse function.

   (Please use different color to sketch and indicate each equation and show intercepts on the graph.)



(b) Find the domain and range of:

(i) $y = 3^x$

Domain:

Range:

(ii) $y = \log_3 x$

Domain:

Range:

(c) Find the asymptotes of:

(i) $y = 3^x$

(ii) $y = \log_3 x$

(d) Fill in the blank for $y = 3^x$:

(i) As $x \to -\infty$, $y = 3^x \to$_____.

(ii) As $x \to +\infty$, $y = 3^x \to$_____.

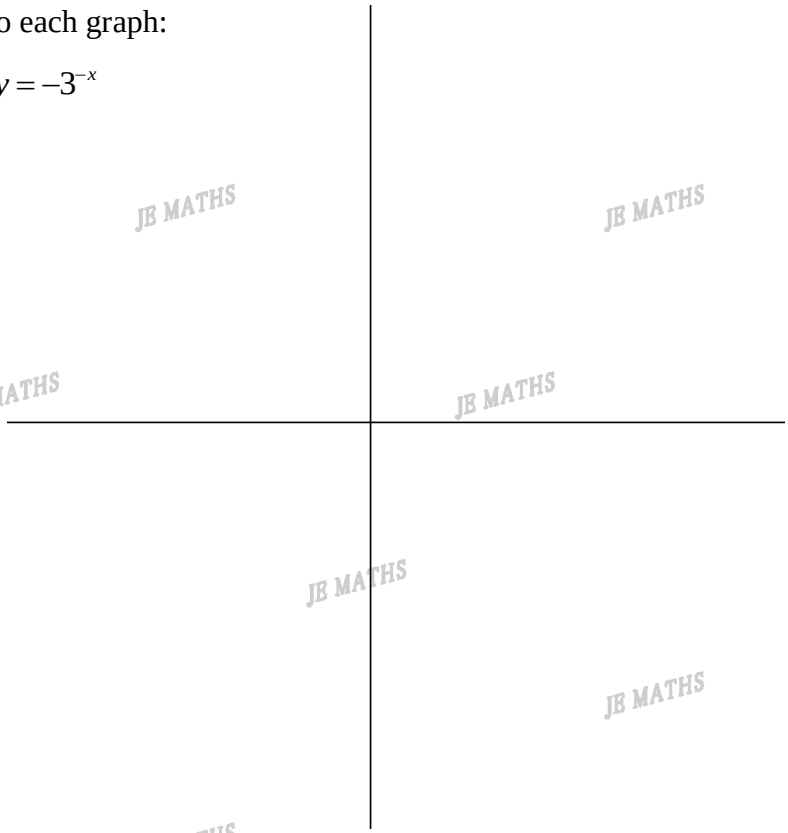
(e) Fill in the blank for $y = \log_3 x$:

(i) As $x \to 0^+$, $y = \log_3 x \to$_____.

(ii) As $x \to +\infty$, $y = \log_3 x \to$_____.

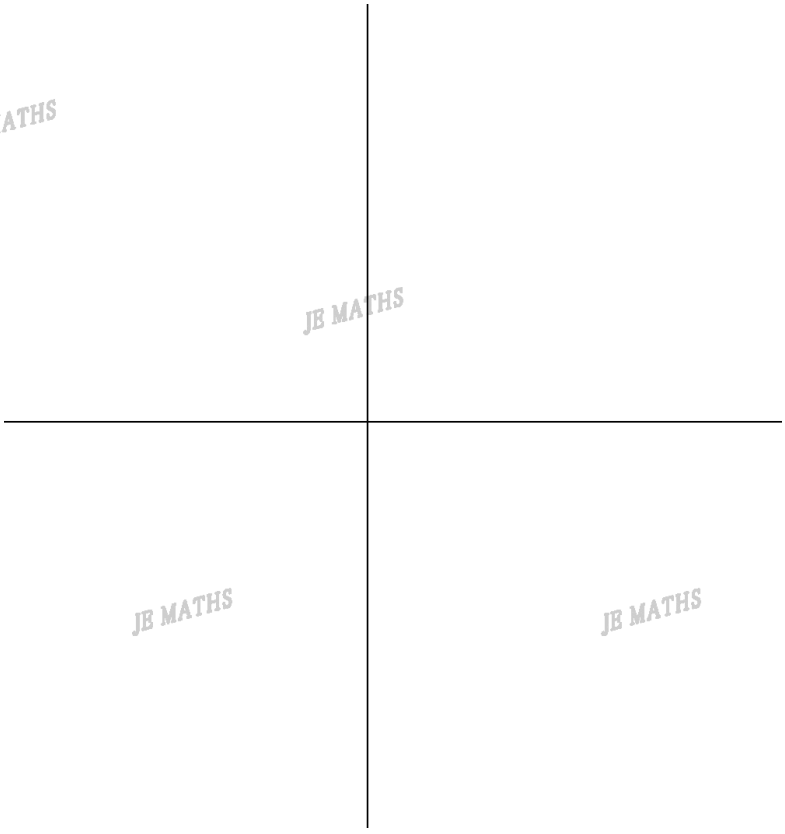
2. Sketch the following 4 sets of graphs on the same number plane by using four different colors and indicate each equation next to each graph:

   $y = 3^x$, $y = 3^{-x}$, $y = -3^x$ and $y = -3^{-x}$



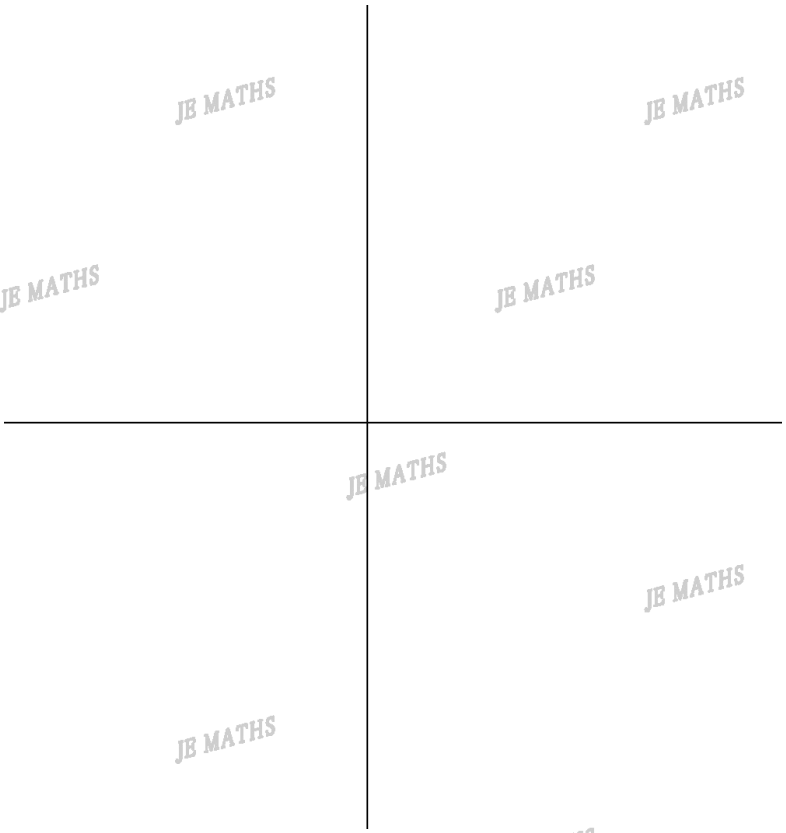
3. Sketch the following sets of graphs on the same number plane by using different colors and indicate each equation next to the graph and showing y-intercepts and asymptotes if necessary:

   $y = 3^x$, $y = 3^x + 1$ and $y = 3^x - 2$



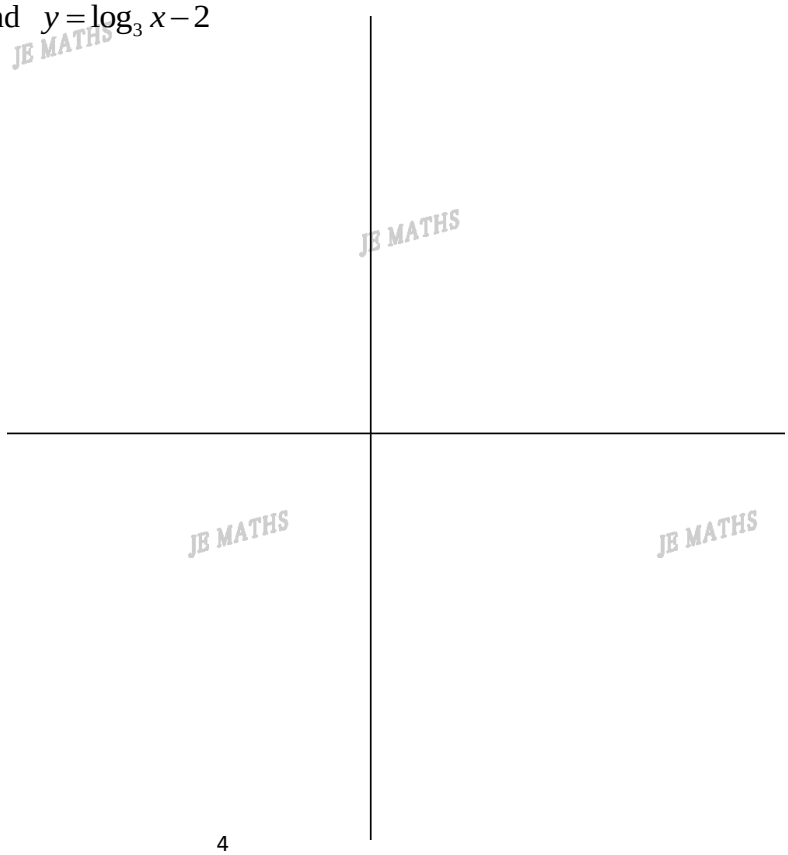
4. Sketch the following 4 sets of graphs on the same number plane by using four different colors and indicate each equation next to the graph and show x-intercepts if necessary:

$y = \log_3 x$, $y = \log_3(-x)$, $y = -\log_3 x$ and $y = -\log_3(-x)$



5. Sketch the following sets of graphs on the same number plane by using different colors and indicate each equation next to each graph:

$y = \log_3 x$, $y = \log_3 x + 1$ and $y = \log_3 x - 2$



Foundation stage 3:

1. (a) Given that $y = 2 \times 5^x$, find the value of y, correct to 3 siginificant figure if necessary, when

   (i) x = 3. (ii) x = 1.5,

   (b) Make x the subject of the equation.

   (c) Hence, find the value of x, correct to 3 siginificant figure if necessary, when
   (i) y = 50. (ii) y = 6

2. (a) A quantity Q is varying over time t according to the formula $Q = 3 \times 2^{\frac{t}{2}}$, find the value of Q, correct to 3 siginificant figure if necessary, when
   (i) t = 10. (ii) t = 7.

   (b) Make t the subject of the equation.

   (c) Hence, find the value of t, correct to 3 siginificant figure if necessary, when
   (i) Q = 24. (ii) Q = 8.

3. (a) Given that $y = 2\log_3 x$, find the value of y, correct to 3 siginificant figure if necessary, when

(i) x = 9. (ii) x = 8.

(b) Make x the subject of the equation.

(c) Hence, find the value of x, correct to 3 siginificant figure, when

(i) y = 8. (ii) y = 7.

4. (a) A quantity Q is varying over time t according to the formula $Q = 3\log_2 2t$,

find the value of Q, correct to 3 siginificant figure if necessary, when

(i) t = 8. (ii) t = 7.

(b) Make t the subject of the equation.

(c) Hence, find the value of t, correct to 3 siginificant figure, when

(i) Q = 9. (ii) Q = 5.

Foundation stage 1:

1. (a)
   1.46

   (b)
   -0.63

   (c)
   -1.21

   (d)
   -0.58

2. (a)
   x = $log_3 15$
   x = 2.46

   (b)
   x = $log_3 1.5$
   x = 0.37

   (c)
   x = $log_4 0.15$
   x = -1.37

   (d)
   x = $log_{40} 0.5$
   x = -0.19

   (e)
   x = $log_{0.5} 0.05$
   x = 4.32

   (f)
   x = $log_{0.007} 1.234$
   x = -0.04

3. (a)
   $2^x > 2^3$
   x>3

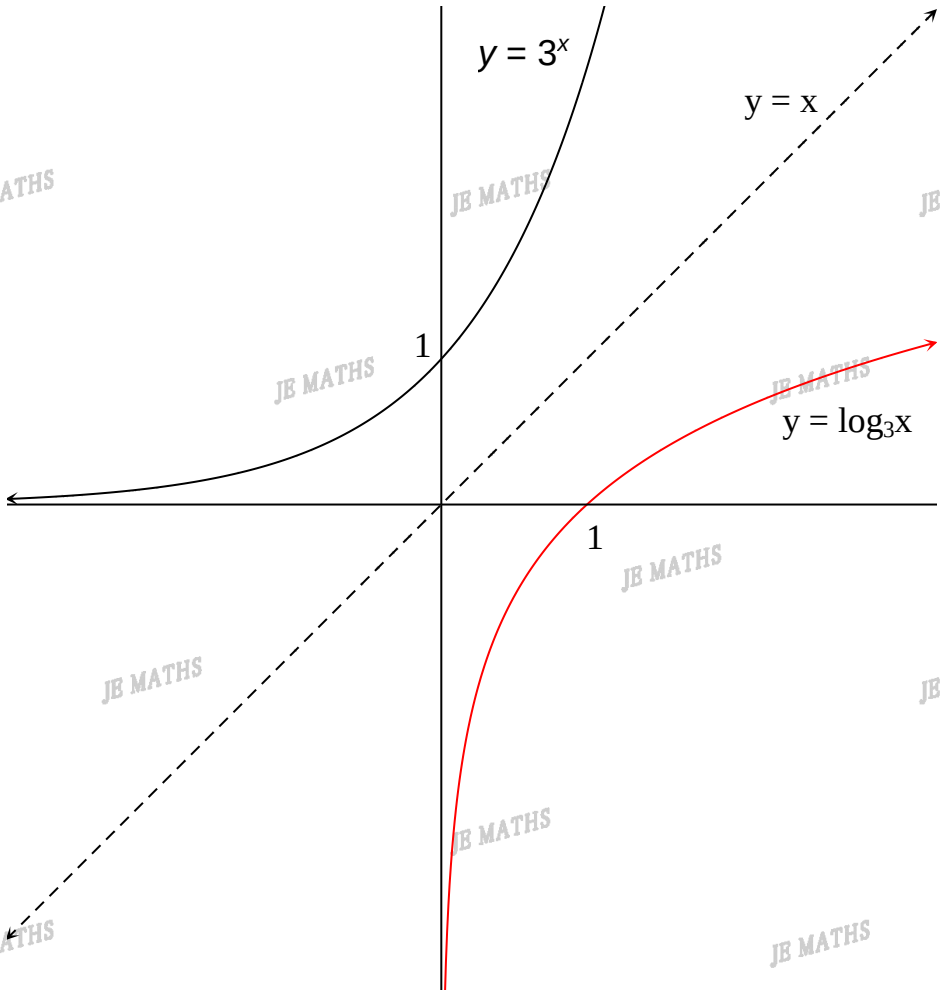
   (b)
   $2^x \leq 2^3$
   x≤3

   (c)
   $3^x > 3^{-2}$
   x>-2

   (d)
   $10^x \leq 10^{-3}$
   x≤ −3

Foundation stage 2:

1. (a)



(b)

(i)
x∈R
y>0

(ii)
x>0
y∈R

(c)

(i)
horizontal asymptote: y = 0

(ii)
vertical asymptote: x = 0

(d)

(i)
0^+

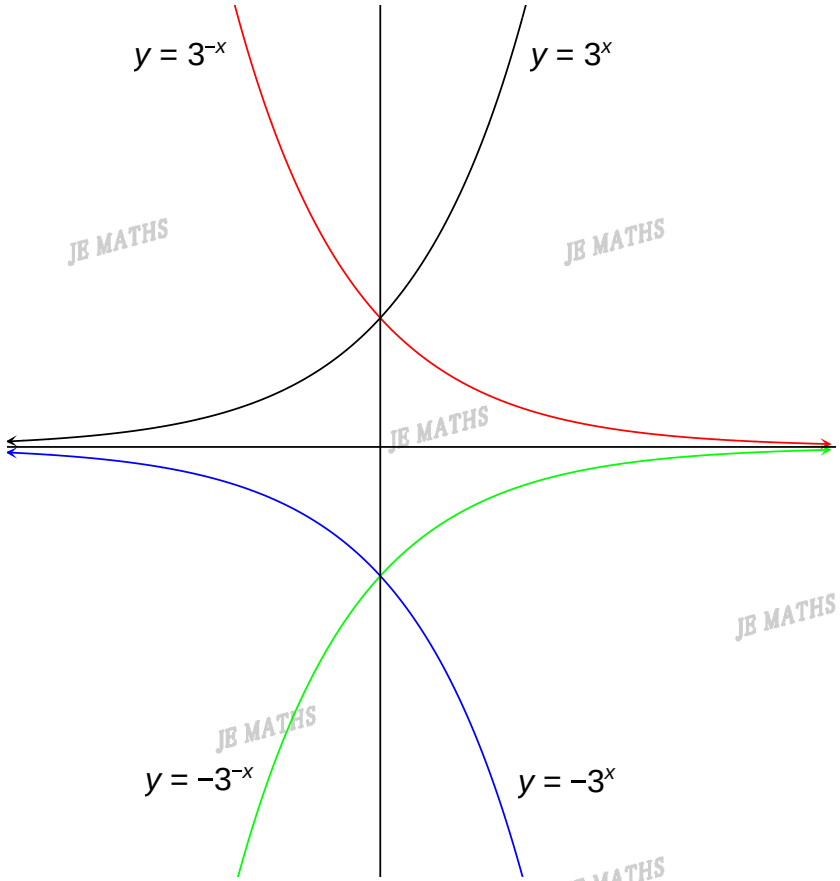
(ii)
$+\infty$

(e)

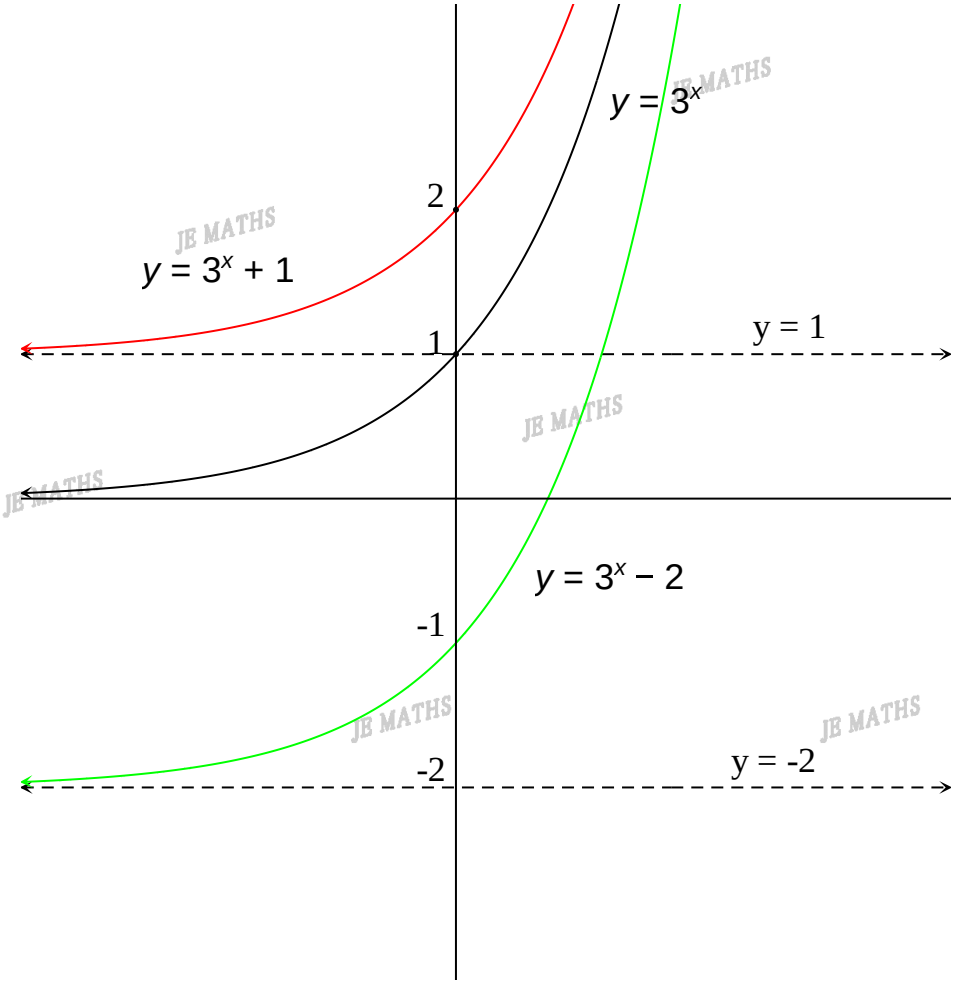
(i)
$-\infty$

(ii)
$+\infty$

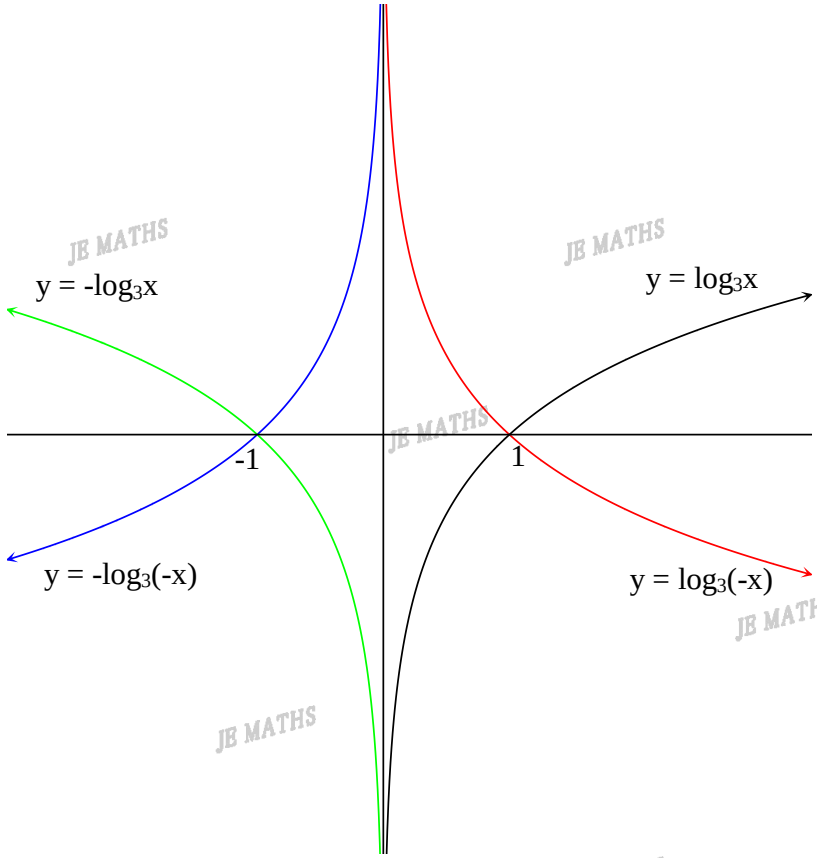
2.



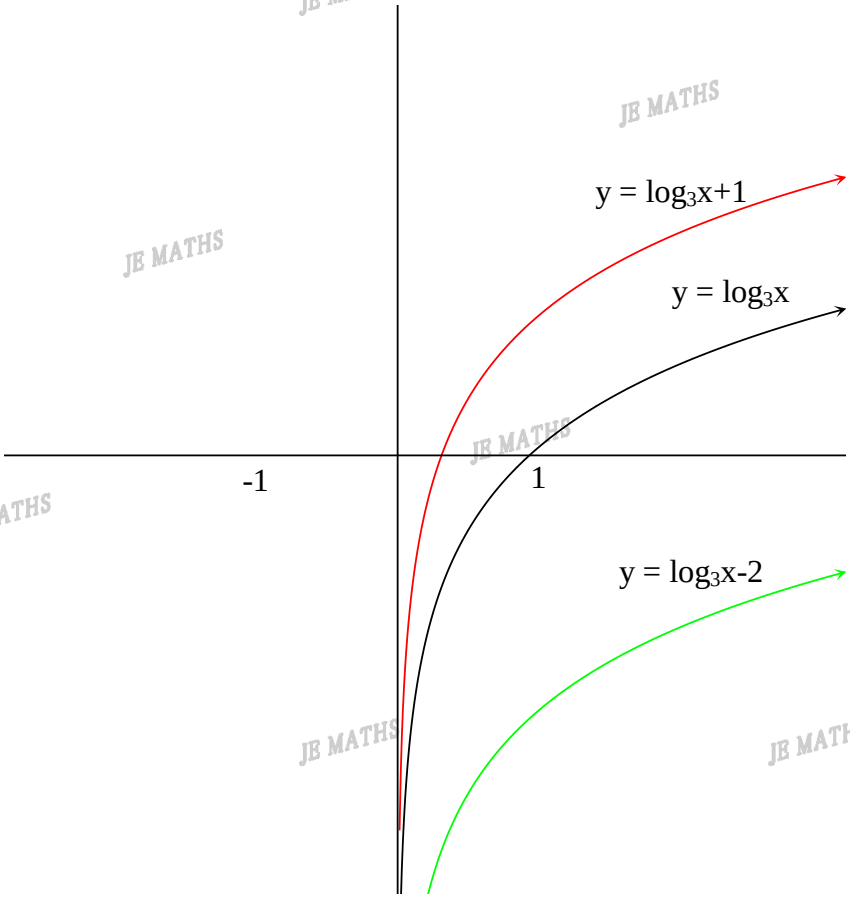
3.



4.



5.



Foundation stage 3:

1. (a)

   (i)
   $y = 2 \times 5^{3} = 250$

   (ii)
   $y = 2 \times 5^{1.5} = 22.4$

   (b)
   $y/2 = 5^{x}$
   $x = log_5(y/2)$

   (c)
   (i)
   $x = log_5(50/2)$
   $x = log_5 25$
   $x = 2$

   (ii)
   $x = log_5(6/2)$
   $x = log_5 3$
   $x = log_5 3$

2. (a)

   (i)
   $Q = 3 \times 2^{10/2} = 96$

   (ii)
   $Q = 3 \times 2^{7/2} = 33.9$

   (b)
   $Q/3 = 2^{t/2}$
   $t/2 = log_2(Q/3)$
   $t = 2log_2(Q/3)$

   (c)
   (i)
   $t = 2log_2(24/3)$
   $t = 2log_2 8$
   $t = 6$

   (ii)
   $t = 2log_2(8/3)$
   $t = 1.42$

3. (a)

   (i)
   $y = 2 \times log_3 9$
   $y = 2 \times 2$
   $y = 4$

   (ii)
   $y = 2 \times log_3 8$
   $y = 3.79$

   (b)
   $y/2 = log_3 x$
   $x = 3^{y/2}$

   (c)
   (i)
   $x = 3^{8/2}$
   $x = 81$

   (ii)
   $x = 3^{7/2}$
   $x = 46.8$

4. (a)

(i)

Q = $3 \times log_2 16$

Q = 3×4

Q = 12

(ii)

Q = $3 \times log_2 14$

Q = 11.4

(b)

Q/3 = $log_2 2t$

$2t = 2^{Q/3}$

$t = 1/2 \times 2^{Q/3}$

$t = 2^{-1}2^{Q/3}$

$t = 2^{Q/3-1}$

(c)

(i)

$t = 2^{9/3-1}$

t = 4

(ii)

$t = 2^{5/3-1}$

t = 1.59