



**Calculator Assumed**  
**Exponential Functions and Graphs**

Time: 45 minutes  
Total Marks: 45  
Your Score: / 45

**Question One: [3, 2, 2, 2 = 9 marks]**

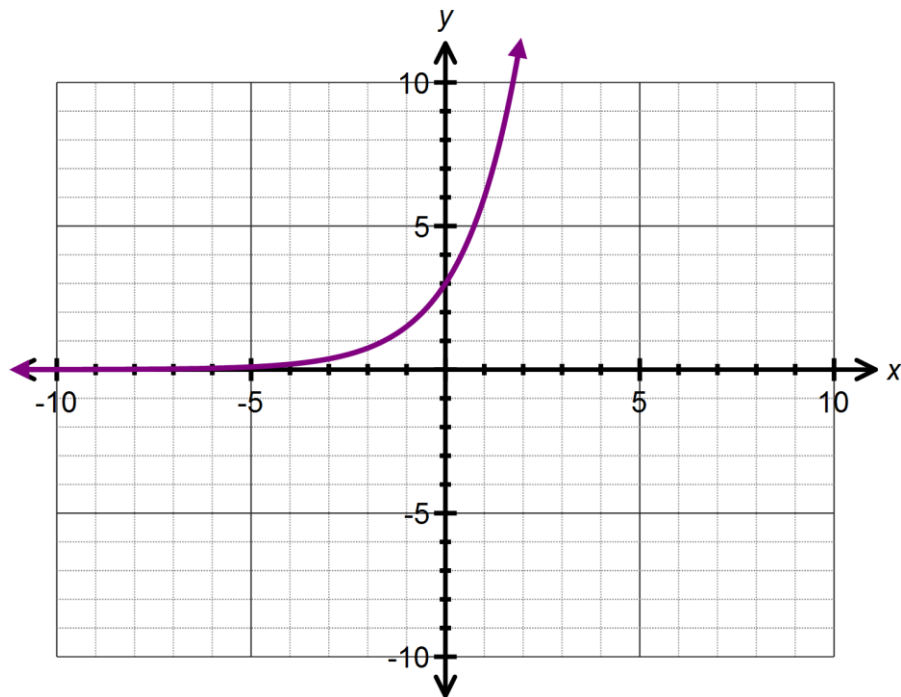
Consider the following functions:

$$\begin{array}{llll} y = 2^x & y = \frac{5}{x} & y = -3x^2 & y = \frac{1}{4^x} \\ xy = -2 & y = x^3 & y = 0.25^x & y = 3 \times 2^x \\ y = 1^x & y = 0.5^x & & \end{array}$$

- (a) State all the equations that represent exponential functions.
- (b) State the two equations which represent the same exponential function.
- (c) State the equations which represent increasing exponential functions.
- (d) State the equations which represent decreasing exponential functions.

**Question Two:** [2, 2, 2, 2 = 8marks]

Consider the graph of  $y = f(x)$  drawn below.



- (a) Determine the equation of the function  $f(x)$  .
  
  
  
  
  
- (b) State the domain and range of  $f(x)$  .
  
  
  
  
  
- (c) Describe how the function  $y = -f(x) + 2$  is transformed from  $f(x)$  .
  
  
  
  
  
- (d) Sketch  $y = -f(x) + 2$  on the axes above.

**Question Three: [4, 5 = 9 marks]**

Consider the function  $g(x) = 3^x$

(a)

- (i) State the equation of the horizontal asymptote.
- (ii) If the function is translated 4 units down, state the equation defining the new function.
- (iii) Using your answer to part (ii) or otherwise, state the equation of the asymptote for the newly translated function.
- (iv) State the coordinate for the  $y$ -intercept of the newly translated function.

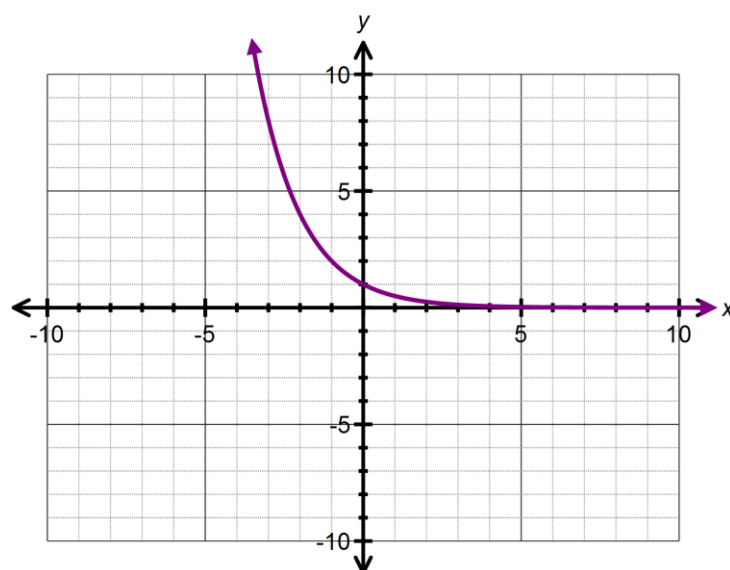
(b) If the function is translated 2 units left, determine:

- (i) Two equivalent expressions which define the newly translated function.
- (ii) Where the  $y$ - intercept has been translated to.
- (iii) The  $y$  – intercept of the newly translated function.

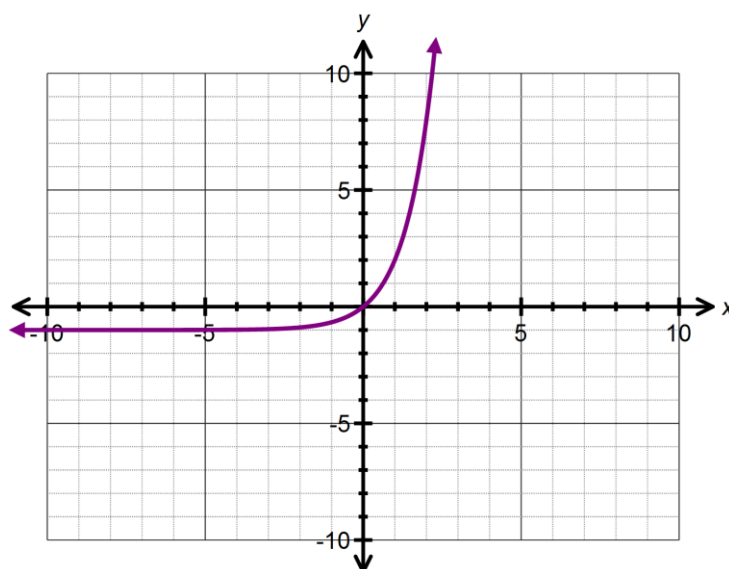
**Question Four: [2, 2, 2, 2, 3, 3 =14 marks]**

Determine the equation of each of the following functions:

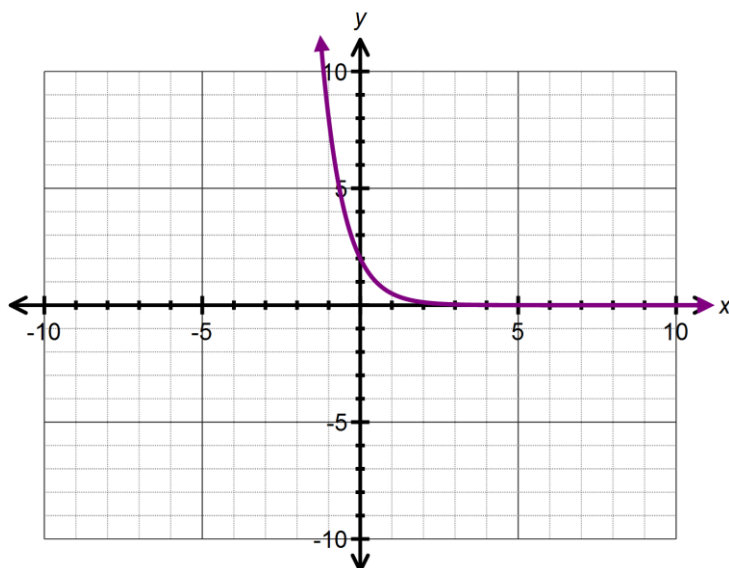
(a)



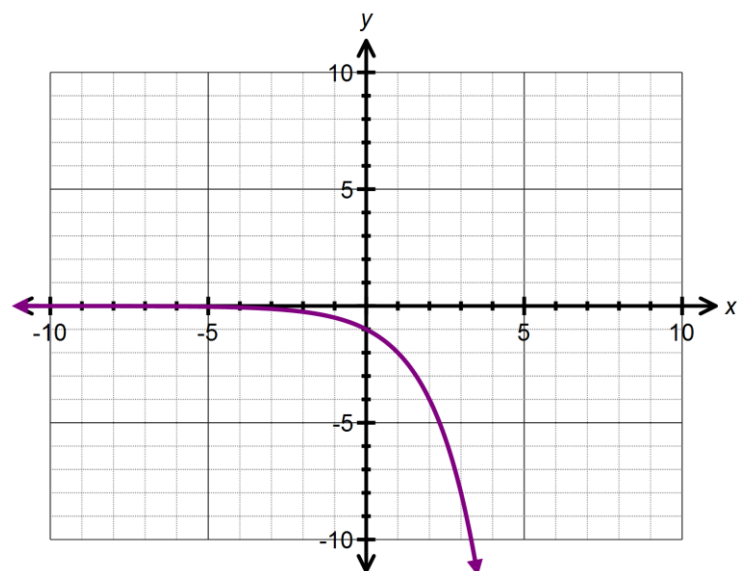
(b)



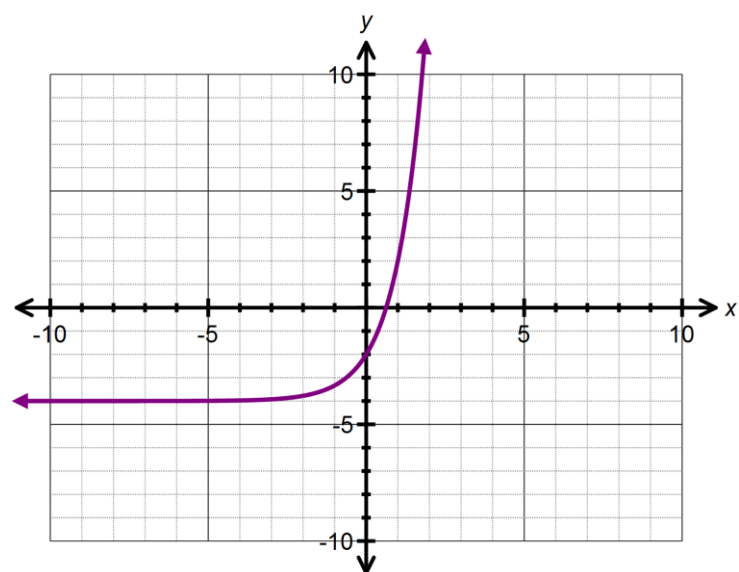
(c)



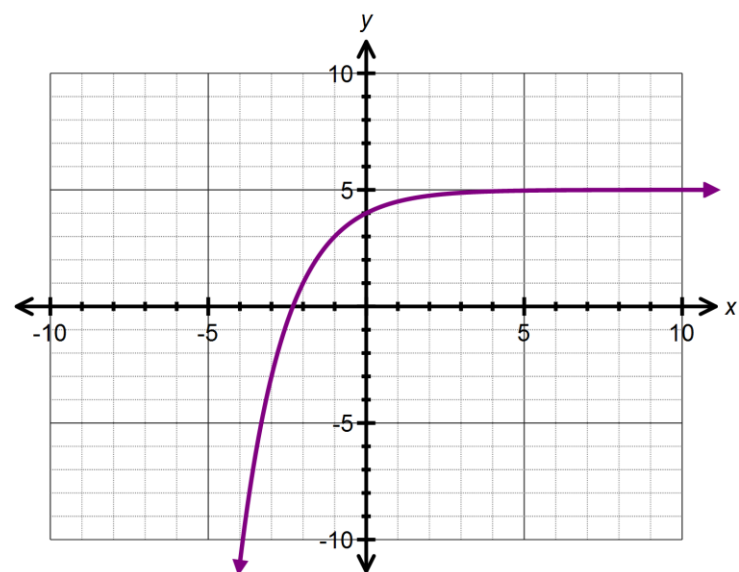
(d)



(e)



(f)



**Question Five: [2, 2, 1 = 5 marks]**

The function  $f(x)$  has been transformed and now has equation  $y = 6 \times 2^{x-1}$

- (a) Describe the two transformations that have occurred.
- (b) These two transformations are the equivalent of one single transformation. State the single transformation which results in the same function.
- (c) Hence or otherwise determine the  $y$  – intercept of the transformed function.



**SOLUTIONS**  
**Calculator Assumed**  
**Exponential Functions and Graphs**

Time: 45 minutes  
 Total Marks: 45  
 Your Score: / 45

**Question One: [3, 2, 2, 2 = 9 marks]**

Consider the following functions:

$$\begin{array}{llll} y = 2^x & y = \frac{5}{x} & y = -3x^2 & y = \frac{1}{4^x} \\ xy = -2 & y = x^3 & y = 0.25^x & y = 3 \times 2^x \\ y = 1^x & y = 0.5^x & & \end{array}$$

- (a) State all the equations that represent exponential functions.

$$y = 2^x, y = \frac{1}{4^x}, y = 0.25^x, y = 3 \times 2^x, y = 0.5^x$$

✓✓✓

- (b) State the two equations which represent the same exponential function.

$$y = \frac{1}{4^x}, y = 0.25^x$$

✓✓

- (c) State the equations which represent increasing exponential functions.

$$y = 2^x, y = 3 \times 2^x$$

✓✓

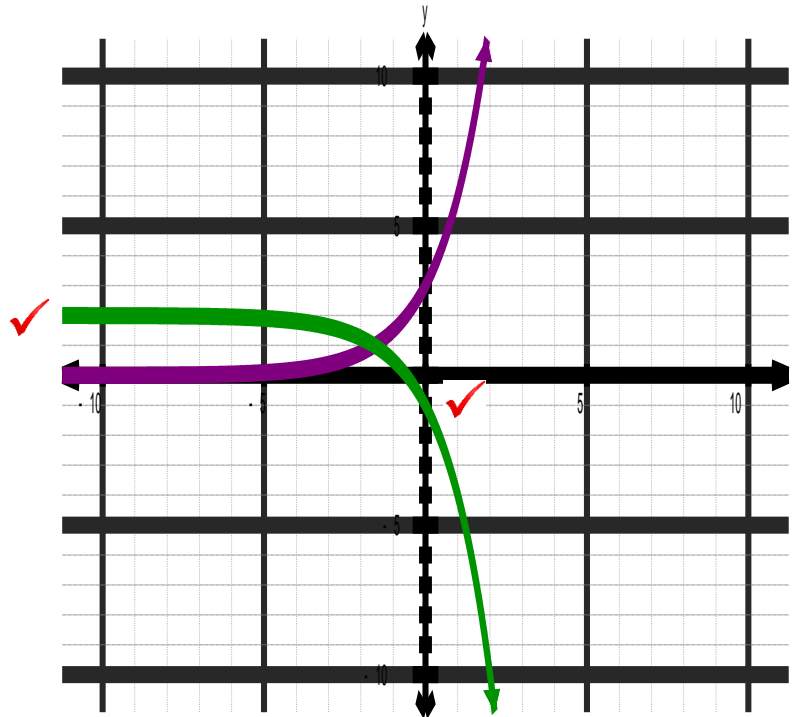
- (d) State the equations which represent decreasing exponential functions.

$$y = \frac{1}{4^x}, y = 0.25^x, y = 0.5^x$$

✓✓✓

**Question Two:** [2, 2, 2, 2 = 8marks]

Consider the graph of  $y = f(x)$  drawn below.



- (a) Determine the equation of the function  $f(x)$  .

$$f(x) = 3 \times 2^x$$



- (b) State the domain and range of  $f(x)$  .

$$D : \{x \in \mathbb{R}\} \quad \checkmark$$

$$R : \{y > 0, y \in \mathbb{R}\} \quad \checkmark$$

- (c) Describe how the function  $y = -f(x) + 2$  is transformed from  $f(x)$  .

Reflected over the x-axis and vertically translated 2 units up



- (d) Sketch  $y = -f(x) + 2$  on the axes above.



**Question Three: [4, 5 = 9 marks]**

Consider the function  $g(x) = 3^x$

(a)

- (i) State the equation of the horizontal asymptote.

$y = 0$  ✓

- (ii) If the function is translated 4 units down, state the equation defining the new function.

$g(x) = 3^x - 4$  ✓

- (iii) Using your answer to part (ii) or otherwise, state the equation of the asymptote for the newly translated function.

$y = -4$  ✓

- (iv) State the coordinate for the  $y$ -intercept of the newly translated function.

$(0, -3)$  ✓

(b) If the function is translated 2 units left, determine:

- (i) Two equivalent expressions which define the newly translated function.

$g(x) = 3^{x+2}$  ✓  $g(x) = 9 \times 3^x$  ✓ ✓

- (ii) Where the  $y$ -intercept has been translated to.

$(-2, 1)$  ✓

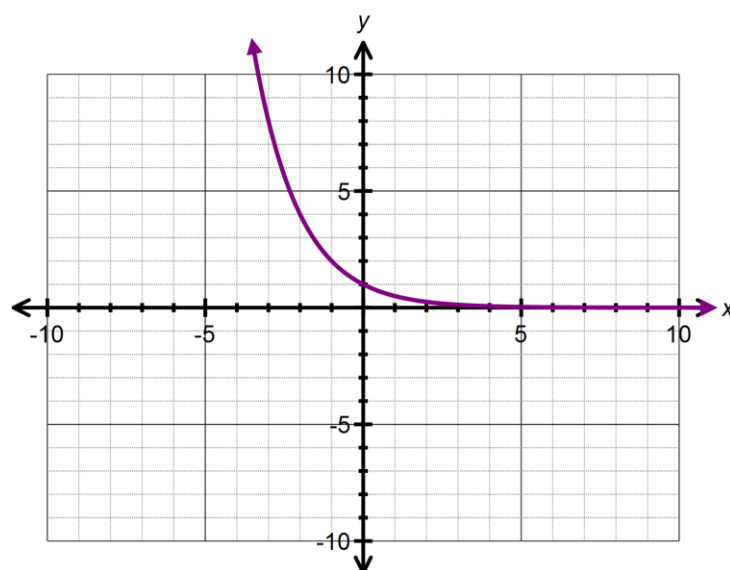
- (iii) The  $y$ -intercept of the newly translated function.

$(0, 9)$  ✓

**Question Four: [2, 2, 2, 2, 3, 3 =14 marks]**

Determine the equation of each of the following functions:

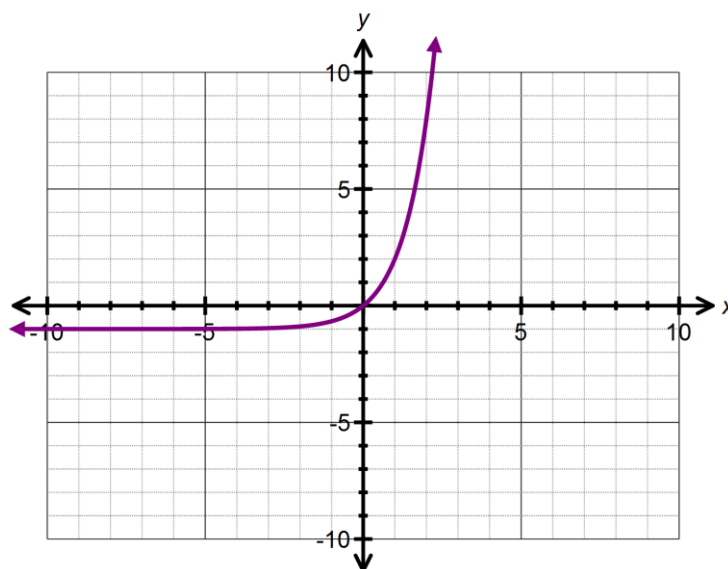
(a)



$$y = 0.5^x$$

✓ ✓

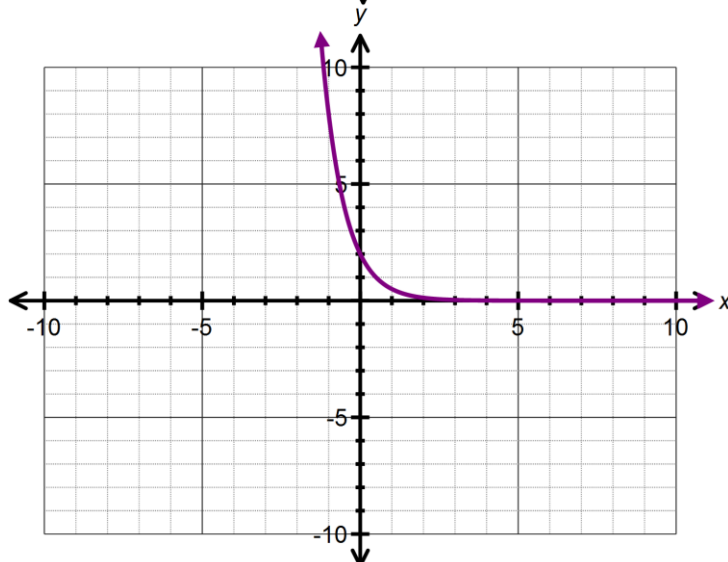
(b)



$$y = 3^x - 1$$

✓ ✓

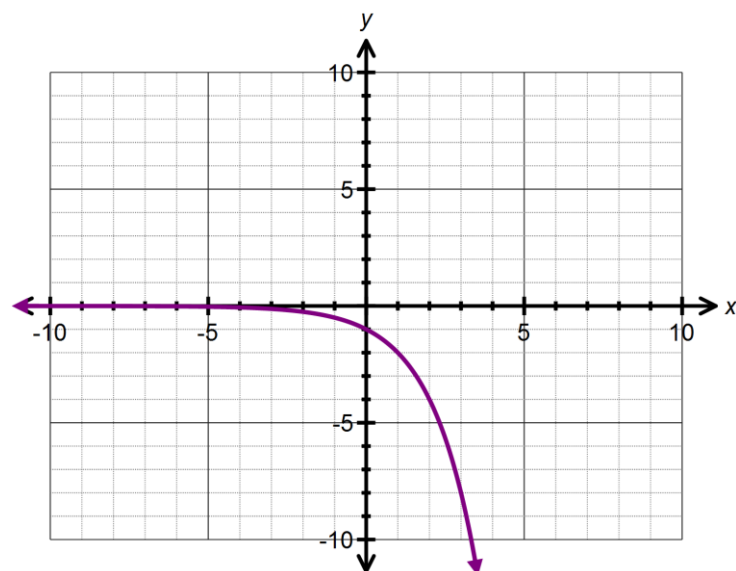
(c)



$$y = 2 \times 0.25^x$$

✓ ✓

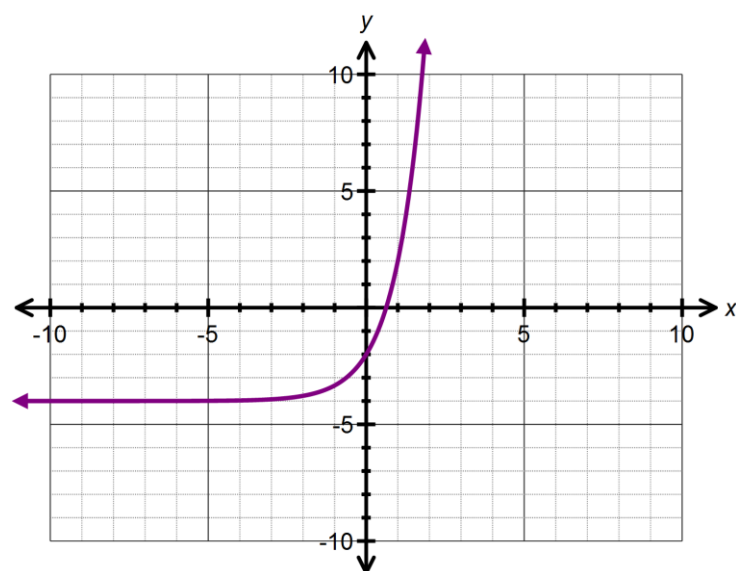
(d)



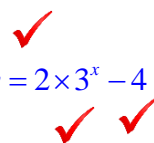
$$y = -2^x$$



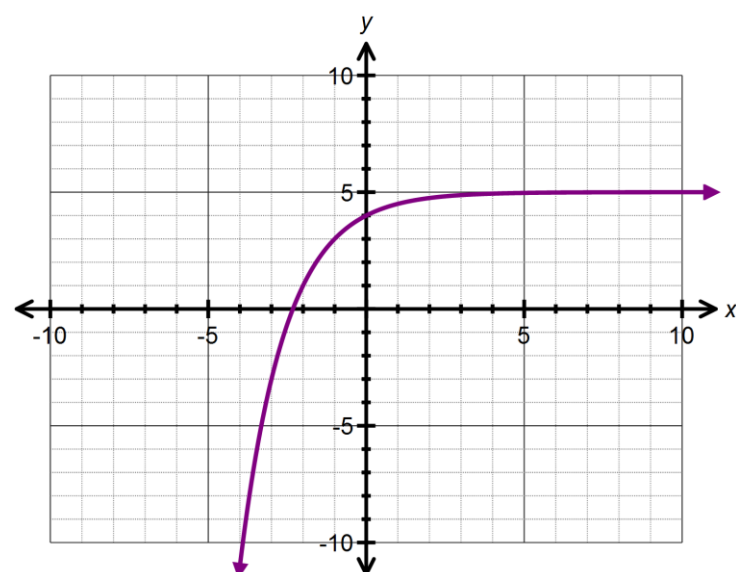
(e)



$$y = 2 \times 3^x - 4$$



(f)



$$y = -0.5^x + 5$$



**Question Five: [2, 2, 1 = 5 marks]**

The function  $f(x)$  has been transformed and now has equation  $y = 6 \times 2^{x-1}$

- (a) Describe the two transformations that have occurred.

Vertical dilation scale factor 6 ✓

Horizontal translation 1 unit right ✓

- (b) These two transformations are the equivalent of one single transformation. State the single transformation which results in the same function.

Vertical dilation scale factor 3



- (c) Hence or otherwise determine the  $y$  – intercept of the transformed function.

(0,3) ✓