

**33°  
52'  
37''S  
151°  
06'  
04''E**

**10**  
**ADV**

**JE  
MATHS**



- **Shift left/right:**  $y = f(x)$  to  $y = f(x-h)$ ,  $h > 0$

1. Write down the new function if the original function has been **shifted left or right**.

(a)  $y = x^3$  is shifted by 1 unit left.

(b)  $y = \frac{1}{x}$  is shifted by 3 units right.

(c)  $y = 2^x$  is shifted by 5 units left.

(d)  $x - y = 1$  is shifted by 7 units right.

- **Shift up/down:**  $y = f(x)$  to  $y = f(x)+k$  or  $(y-k) = f(x)$ ,  $k > 0$

2. Write down the new function if the original function has been **shifted up or down**.

(a)  $y = x^3$  is shifted by 2 units down.

(b)  $y = \frac{1}{x}$  is shifted by 4 units up.

(c)  $y = 2^x$  is shifted by 6 units down.

(d)  $x - y = 1$  is shifted by 8 units up.

3. Fill in the blank for  $h > 0$  and  $k > 0$ :

(a)  $y = f(x) \xrightarrow{h \text{ right}} y = f(\underline{\hspace{2cm}})$

(b)  $y = f(x) \xrightarrow{h \text{ left}} y = f(\underline{\hspace{2cm}})$

(c)  $y = f(x) \xrightarrow{k \text{ up}} (\underline{\hspace{2cm}}) = f(x)$

(d)  $y = f(x) \xrightarrow{k \text{ down}} (\underline{\hspace{2cm}}) = f(x)$

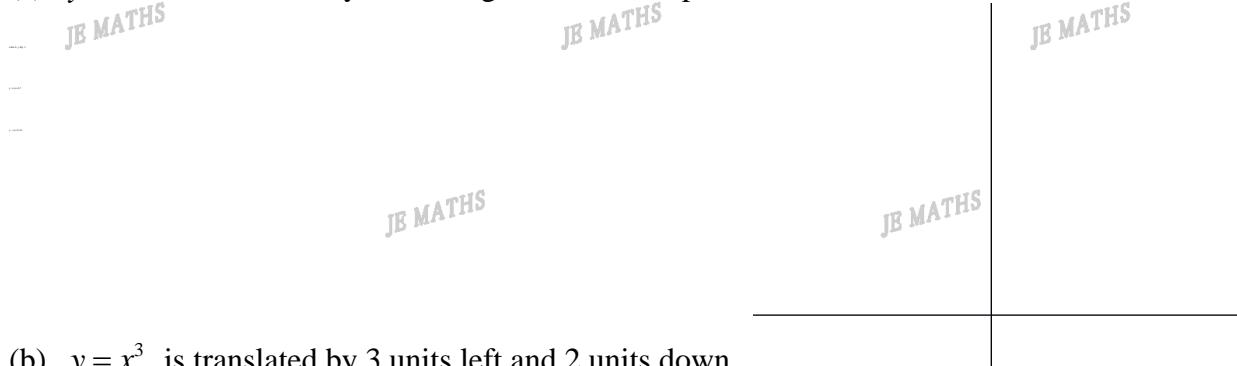
(e)  $y = f(x) \xrightarrow{k \text{ up}} \underline{\hspace{2cm}} = f(\underline{\hspace{2cm}})$

(f)  $y = f(x) \xrightarrow{k \text{ down}} \underline{\hspace{2cm}} = f(\underline{\hspace{2cm}})$

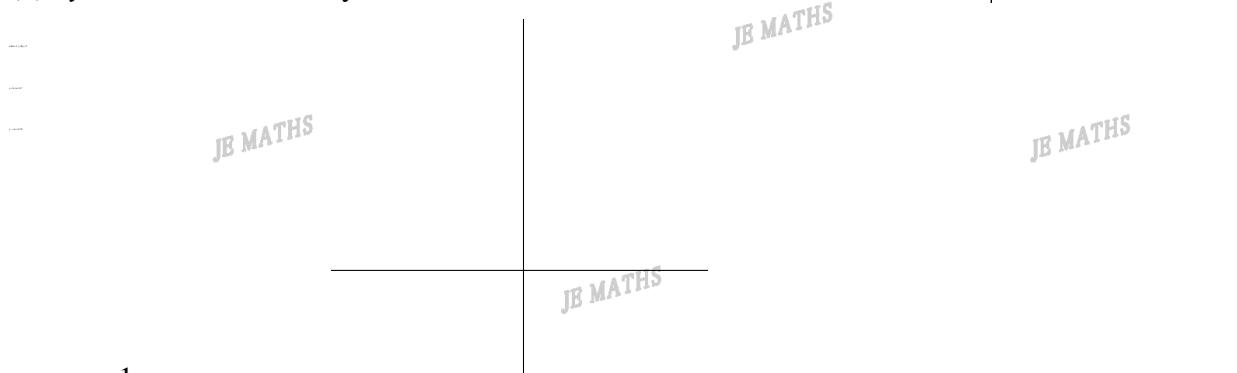
- Mixed translation:  $y = f(x) \xrightarrow[k \uparrow]{h \text{ right}} (y - k) = f(x - h)$

4. Write down the new function if the original function has been translated and then sketch the new function and indicate the new centre and all intercepts:

(a)  $y = x^2$  is translated by 2 units right and 1 unit up.



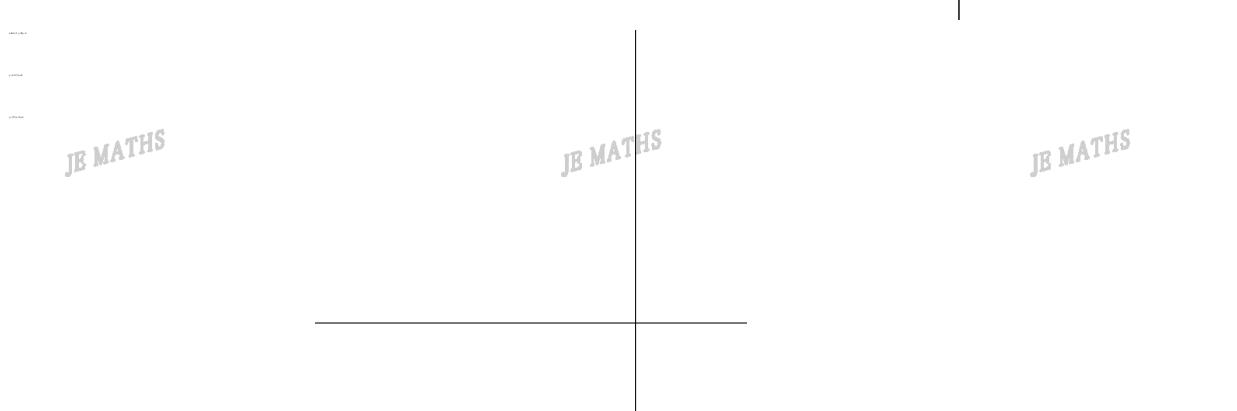
(b)  $y = x^3$  is translated by 3 units left and 2 units down.



(c)  $y = \frac{1}{x}$  is translated by 4 units right and 3 units down.

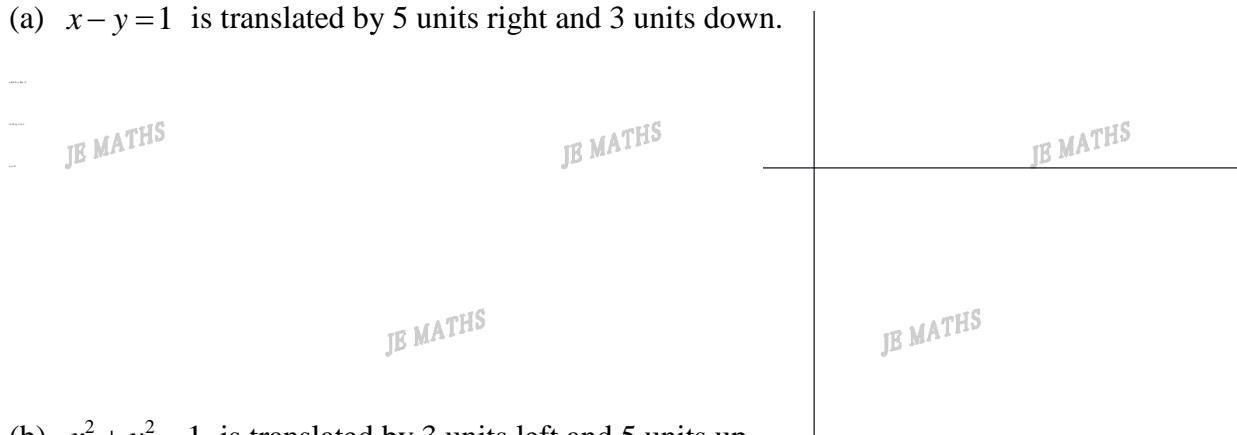


(d)  $y = 2^x$  is translated by 5 units left and 4 units up.

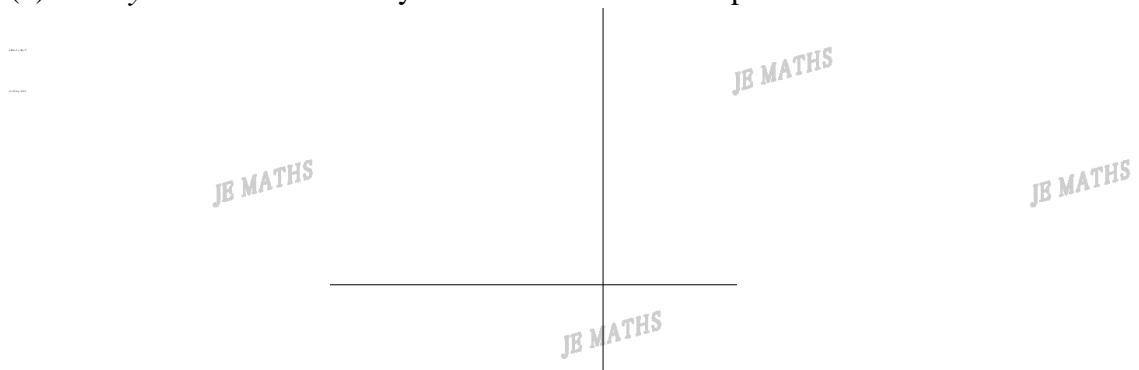


5. Write down the new function if the original function has been translated and then sketch the new function and indicate the new centre and all intercepts:

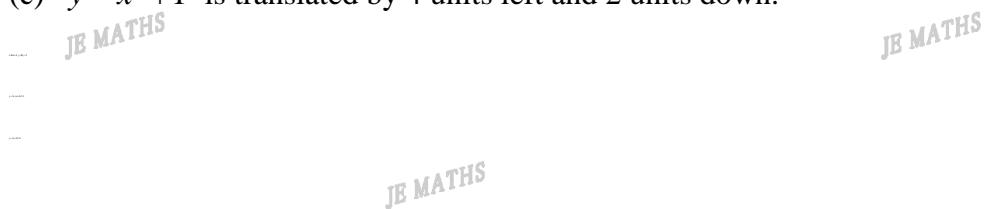
(a)  $x - y = 1$  is translated by 5 units right and 3 units down.



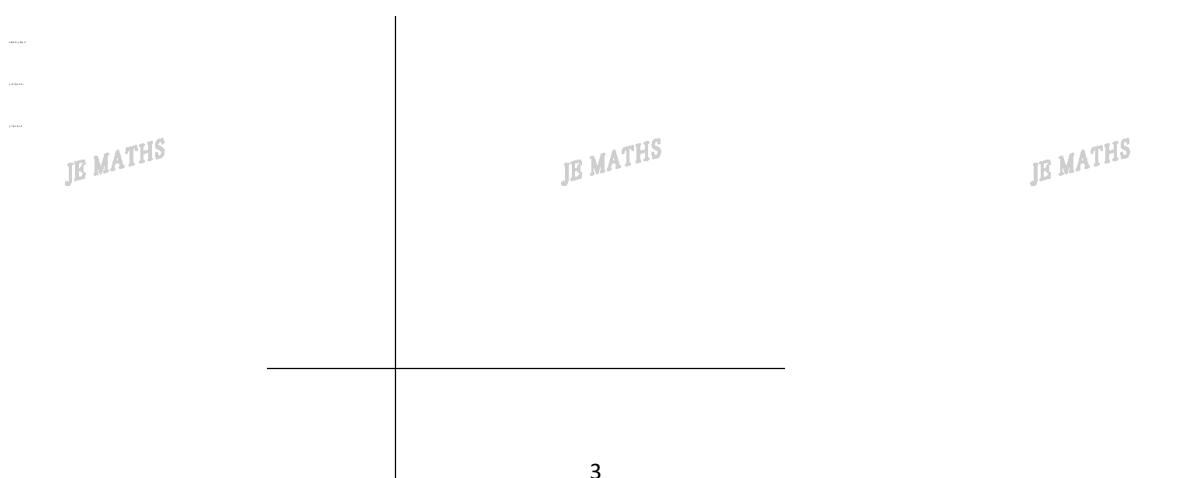
(b)  $x^2 + y^2 = 1$  is translated by 3 units left and 5 units up.



(c)  $y = x^2 + 1$  is translated by 4 units left and 2 units down.



(c)  $y = \sqrt{x-1}$  is translated by 2 units right and 4 units up.



6. Given that an unknown graph. Sketch the functions specified below and indicate where each existing point has been moved to:

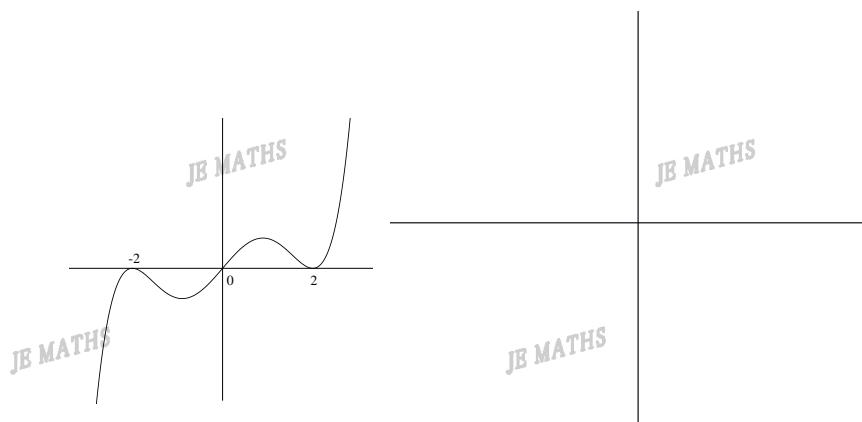
(a)  $y = f(x+2)$

translate by 2 units left

$$(-2, 0) \rightarrow (\underline{\quad}, \underline{\quad})$$

$$(0, 0) \rightarrow (\underline{\quad}, \underline{\quad})$$

$$(2, 0) \rightarrow (\underline{\quad}, \underline{\quad})$$



(b)  $y - 1 = f(x)$

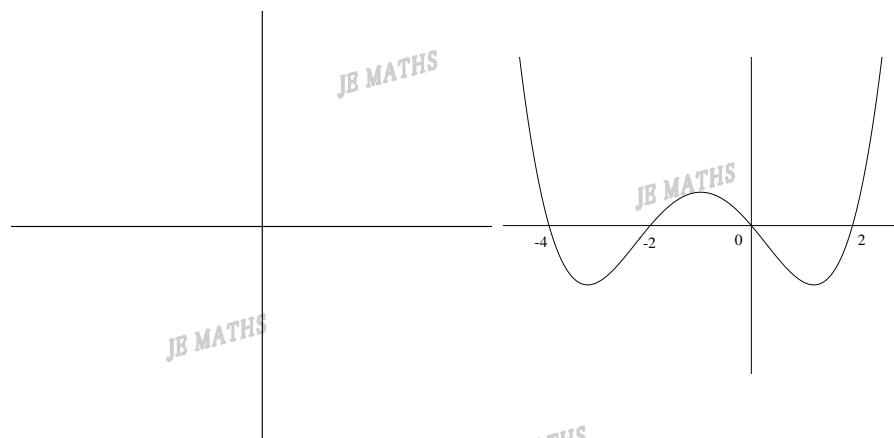
translate by 1 unit up

$$(-4, 0) \rightarrow (\underline{\quad}, \underline{\quad})$$

$$(-2, 0) \rightarrow (\underline{\quad}, \underline{\quad})$$

$$(0, 0) \rightarrow (\underline{\quad}, \underline{\quad})$$

$$(2, 0) \rightarrow (\underline{\quad}, \underline{\quad})$$



(c)  $y - 1 = h(x+2)$

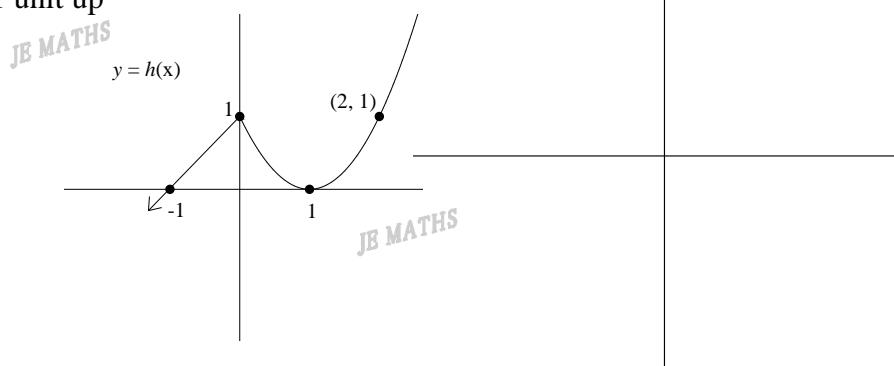
translate by 2 units left and 1 unit up

$$(-1, 0) \rightarrow (\underline{\quad}, \underline{\quad})$$

$$(0, 1) \rightarrow (\underline{\quad}, \underline{\quad})$$

$$(1, 0) \rightarrow (\underline{\quad}, \underline{\quad})$$

$$(2, 1) \rightarrow (\underline{\quad}, \underline{\quad})$$



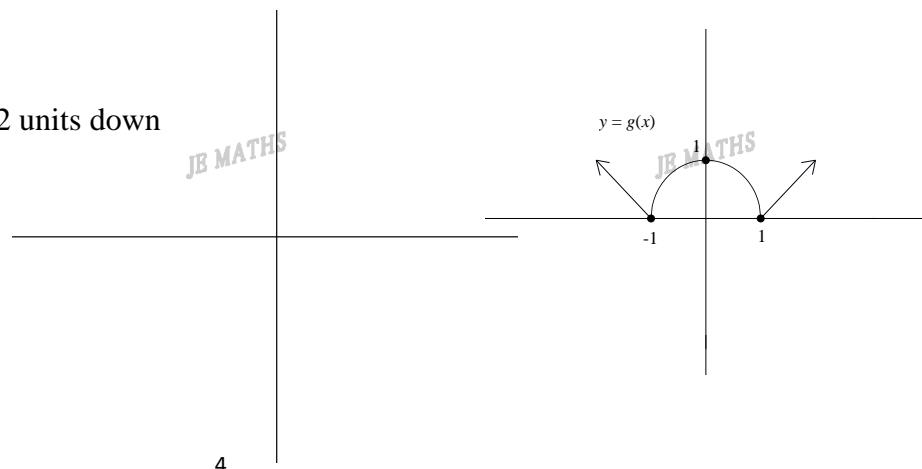
(d)  $y = g(x-1)-2$

translate by 1 unit right and 2 units down

$$(-1, 0) \rightarrow (\underline{\quad}, \underline{\quad})$$

$$(0, 1) \rightarrow (\underline{\quad}, \underline{\quad})$$

$$(1, 0) \rightarrow (\underline{\quad}, \underline{\quad})$$



- Reflect in the **y-axis**:  $y = f(x)$  to  $y = f(-x)$

7. Write down the new function if the original function has been reflected in the **y-axis**.

(a)  $y = x^3$

(b)  $y = 3^x$

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8. Write down the new function if the original function has been reflected in the **y-axis** and then sketch both graphs and indicate all important features on the graph:

(a)  $y = x^2$

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(b)  $y = (x - 2)^3$

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(c)  $y = 3^{x+2}$

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*JB MATHS*

9. Consider the following hyperbola:  $f(x) = \frac{1}{x-2} + 1$ .

(a) Sketch this hyperbola by using **translation only**.

(b) Sketch  $g(x) = \frac{1}{-x-2} + 1$   
on the same number plane by  
using **reflection only**.



(c) If its vertical asymptotes change sign and its horizontal asymptotes are unchanged, which of the following is the correct equation for the new function?

a)  $y = \frac{1}{x-2} + 1$

b)  $y = \frac{1}{-x+2} + 1$

c)  $y = -\frac{1}{x-2} - 1$

d)  $y = -\frac{1}{x+2} + 1$

10. (a) Sketch  $C_1 : (x-1)^2 + y^2 = 4$  and  $C_2 : (x+1)^2 + y^2 = 4$  by using **translation only**.

(b) Which **translation** maps  $C_1$  to  $C_2$ ?

(c) Which **reflection** maps  $C_1$  to  $C_2$ ?

- Reflect in the x-axis:  $y = f(x)$  to  $-y = f(x)$  or  $y = -f(x)$

11. Write down the new function if the original function has been reflected in the x-axis.

(a)  $y = x^2$

(b)  $y = \frac{1}{x}$

12. Write down the new function if the original function has been reflected in the x-axis and then sketch both graphs and indicate all important features on the graph:

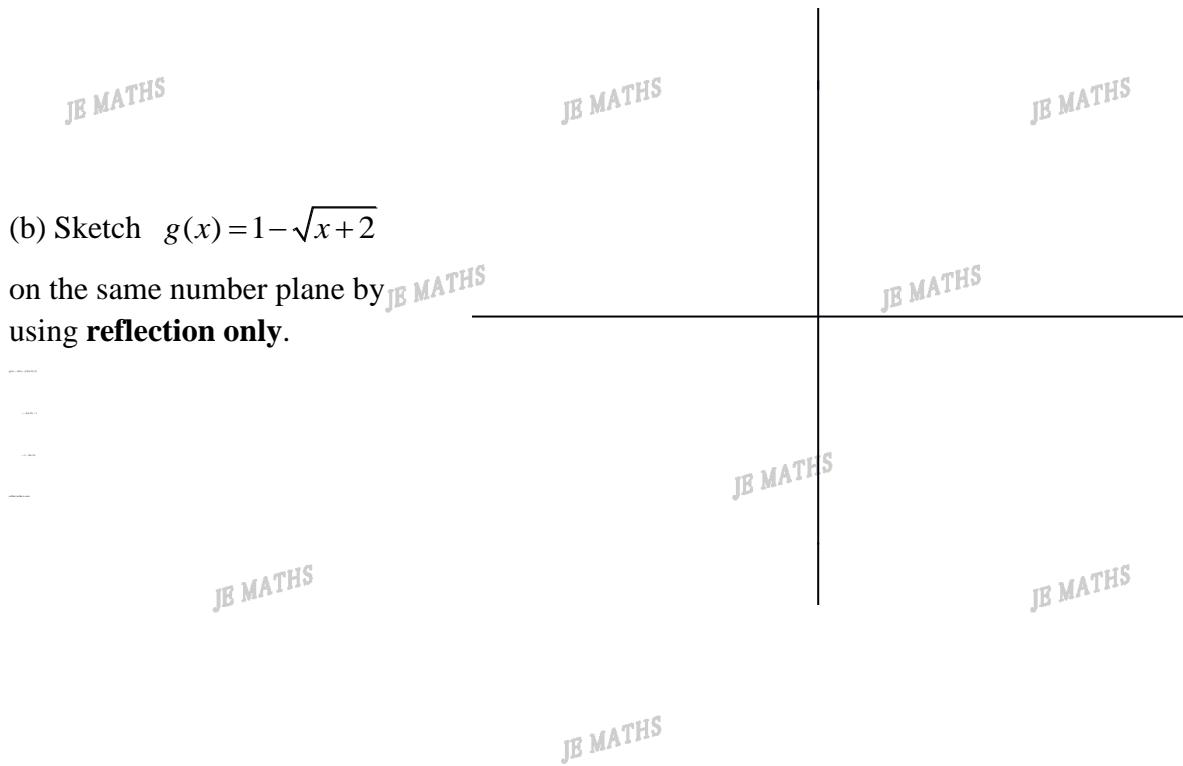
(a)  $y = 2^x$

(b)  $y = (x-3)^2$

(c)  $y = \frac{1}{x+3}$

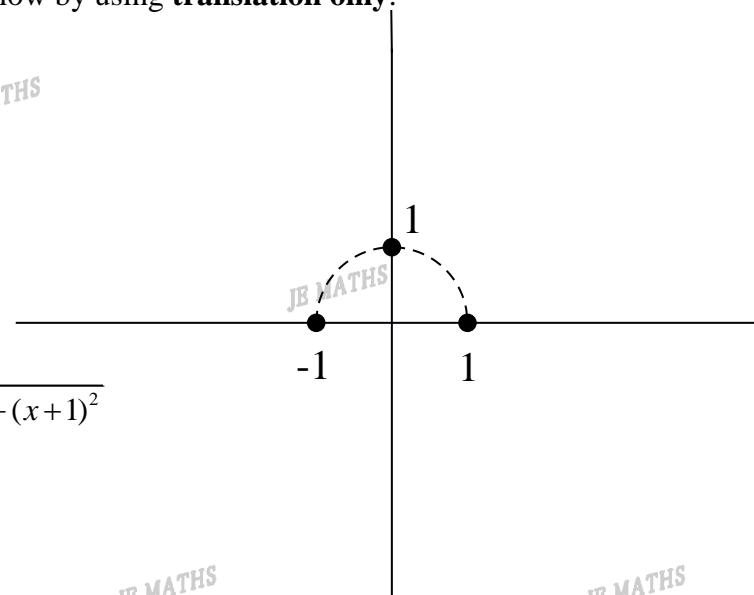
13. Consider the following hyperbola:  $f(x) = \sqrt{x+2} - 1$ .

(a) Sketch this hyperbola by using **translation only**.



14. (a) Sketch the following semicircle function  $(y-2) = \sqrt{1-(x+1)^2}$  from the basic semicircle function  $y = \sqrt{1-x^2}$  given as below by using **translation only**.

(b) Hence, sketch the following semicircle function:  $y = -2 - \sqrt{1-(x+1)^2}$  by using **reflection only**.



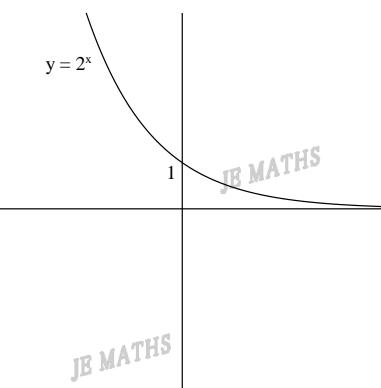
- **Rotation of  $180^\circ$  about the origin:**  $y = f(x)$  to  $-y = f(-x)$  or  $y = -f(-x)$

15. Given the graph of  $y = 2^x$ .

(a) Reflect it in the y-axis.

(b) Reflect it in the x-axis.

(c) Find the equation of the new function.



(d) Will the new function be different if reflected in the x-axis first and then in the y-axis?

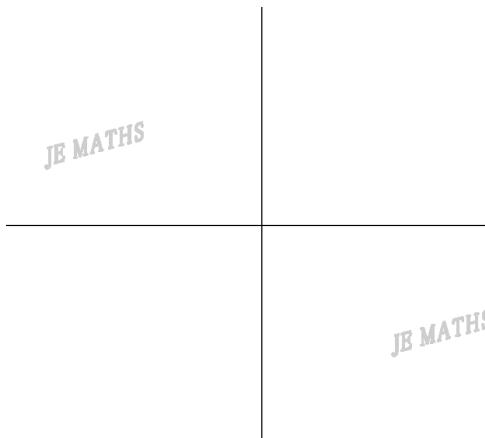
16. Write down the new function if the original function has been rotated by  $180^\circ$ .

(a)  $y = \sqrt{1-x^2}$

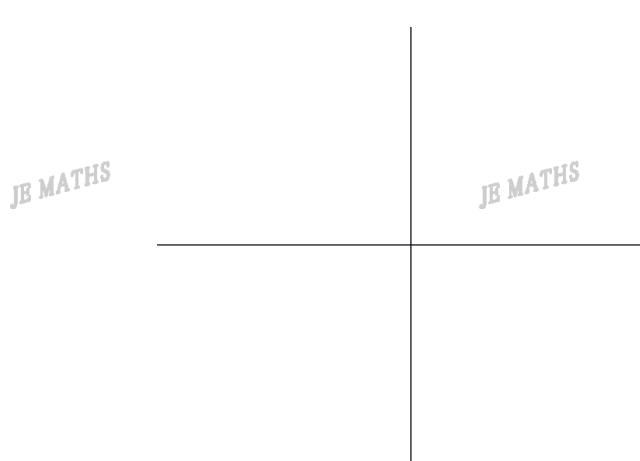
(b)  $y = x^3 - x^2$

17. Write down the new function if the original function has been rotated by  $180^\circ$  and then sketch both graphs:

(a)  $y = x^2 - 4x + 3$



(b)  $y = \frac{1}{x-2} + 1$



18. Given that an unknown graph. Sketch the functions specified below and clearly indicate where each existing point has been moved to:

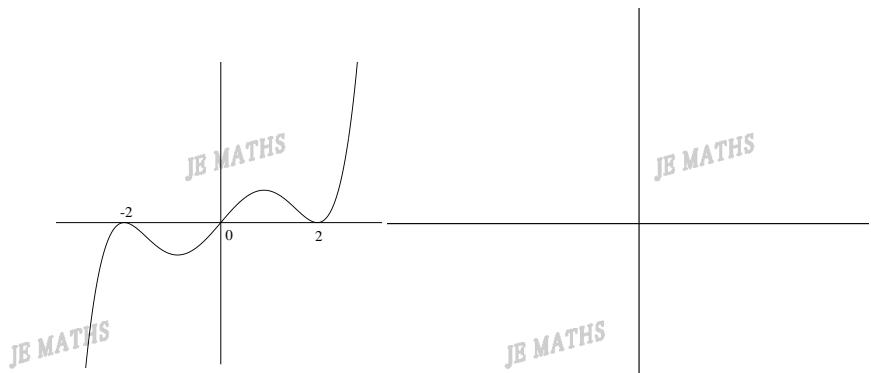
(a)  $y = f(-x)$

reflect in the y-axis

$$(-2, 0) \rightarrow (\underline{\hspace{2cm}}, \underline{\hspace{2cm}})$$

$$(0, 0) \rightarrow (\underline{\hspace{2cm}}, \underline{\hspace{2cm}})$$

$$(2, 0) \rightarrow (\underline{\hspace{2cm}}, \underline{\hspace{2cm}})$$



(b)  $y = -f(x)$

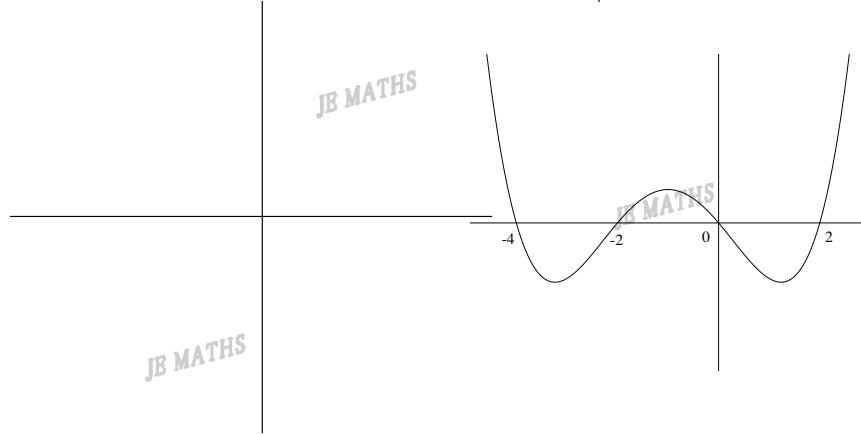
reflect in the x-axis

$$(-4, 0) \rightarrow (\underline{\hspace{2cm}}, \underline{\hspace{2cm}})$$

$$(-2, 0) \rightarrow (\underline{\hspace{2cm}}, \underline{\hspace{2cm}})$$

$$(0, 0) \rightarrow (\underline{\hspace{2cm}}, \underline{\hspace{2cm}})$$

$$(2, 0) \rightarrow (\underline{\hspace{2cm}}, \underline{\hspace{2cm}})$$



(c)  $y = -h(-x)$

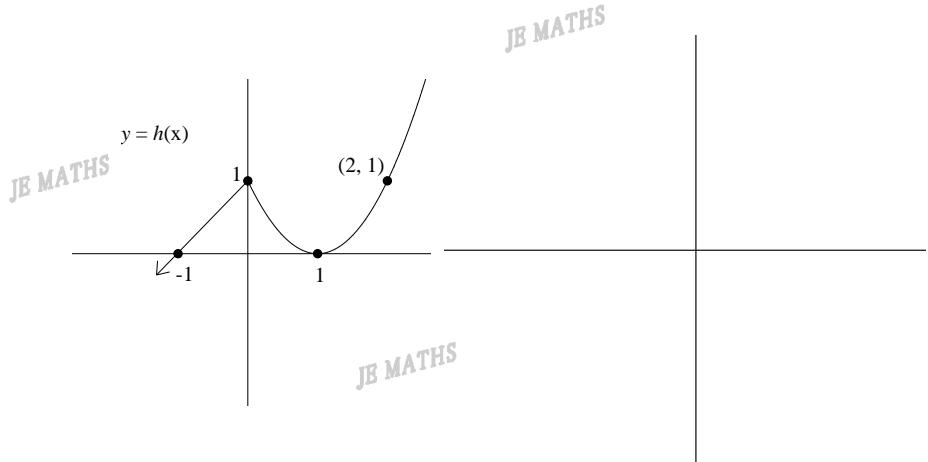
rotated by  $180^\circ$

$$(-1, 0) \rightarrow (\underline{\hspace{2cm}}, \underline{\hspace{2cm}})$$

$$(0, 1) \rightarrow (\underline{\hspace{2cm}}, \underline{\hspace{2cm}})$$

$$(1, 0) \rightarrow (\underline{\hspace{2cm}}, \underline{\hspace{2cm}})$$

$$(2, 1) \rightarrow (\underline{\hspace{2cm}}, \underline{\hspace{2cm}})$$



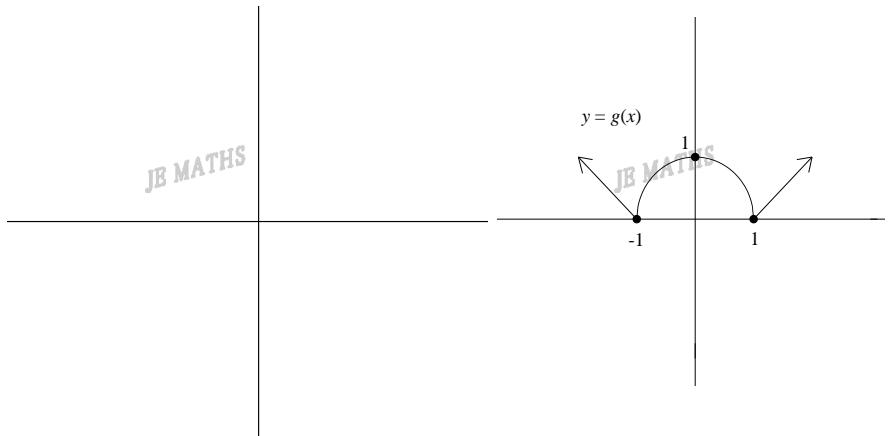
(d)  $y = -g(x-1)$

translate by 1 unit right  
and reflex in the x-axis

$$(-1, 0) \rightarrow (\underline{\hspace{2cm}}, \underline{\hspace{2cm}})$$

$$(0, 1) \rightarrow (\underline{\hspace{2cm}}, \underline{\hspace{2cm}})$$

$$(1, 0) \rightarrow (\underline{\hspace{2cm}}, \underline{\hspace{2cm}})$$







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2
3
<b>Avg:</b>

**Week** \_\_\_\_\_

# HSC

# A

# A

JE  
**MATHS**

Want to  
learn?  
We will  
help u.

•  
Don't  
want to  
learn?  
We will  
change u.

