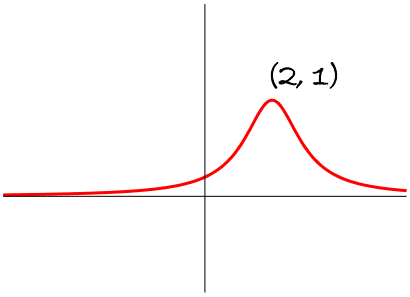
Edexcel AS Mathematics Graphs and transformations

Section 2: Transformations of graphs

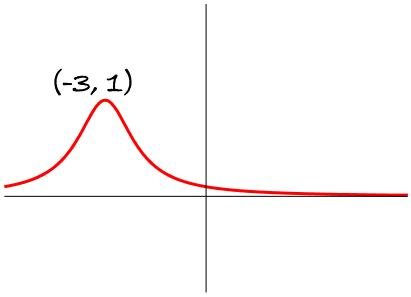
Solutions to Exercise level 2

Do not use a calculator or graph-drawing package for this exercise.

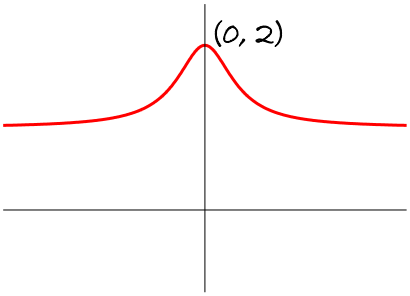
1. (i) $y = f(x - 2)$



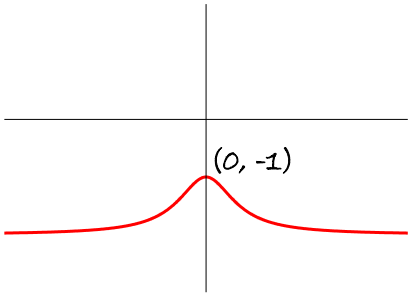
(ii) $y = f(x + 3)$



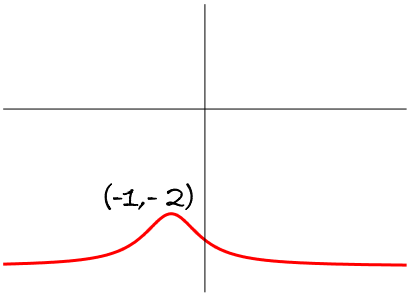
(iii) $y = f(x) + 1$



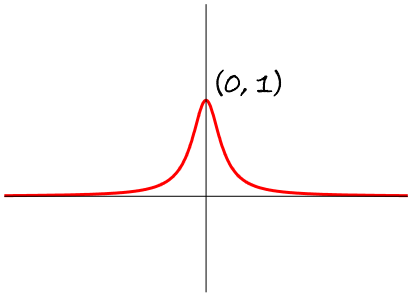
(iv) $y = f(x) - 2$



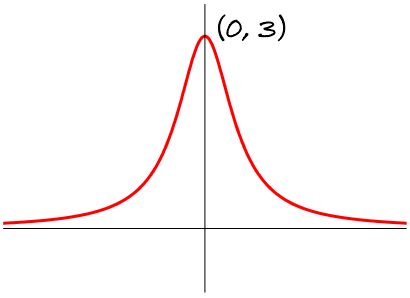
(v) $y = f(x + 1) - 3$



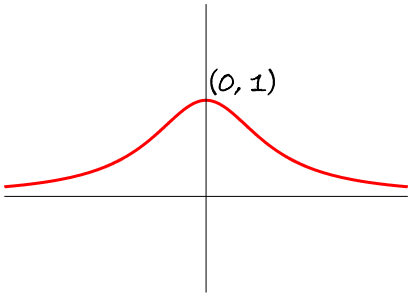
(vi) $y = f(2x)$



(vii) $y = 3f(x)$



(viii) $y = f\left(\frac{1}{2}x\right)$



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2. (i) Translation through $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$ means that f(x) is transformed into f(x – 2)

New graph is $y = (x-2)^2 - (x-2) + 1$

$= x^2 - 4x + 4 - x + 2 + 1$

$= x^2 - 5x + 7$

(ii) Translation through $\begin{pmatrix} 0 \\ -1 \end{pmatrix}$ means that f(x) is transformed into f(x) – 1.

New graph is $y = x^2 - x + 1 - 1$

$= x^2 - x$

(iii) Translation through $\begin{pmatrix} -1 \\ 2 \end{pmatrix}$ means that f(x) is transformed into f(x + 1) + 2.

New graph is $y = (x+1)^2 - (x+1) + 1 + 2$

$= x^2 + 2x + 1 - x - 1 + 3$

$= x^2 + x + 3$

(iv) One-way stretch scale factor 3 parallel to the y axis means that f(x) is transformed into 3f(x).

New graph is $y = 3(x^2 - x + 1)$

$= 3x^2 - 3x + 3$

(v) One-way stretch scale factor $\frac{1}{2}$ parallel to the x axis means that f(x) is transformed into f(2x).

New graph is $y = (2x)^2 - 2x + 1$

$= 4x^2 - 2x + 1$

(vi) Reflection in the x-axis means that f(x) is transformed into –f(x).

New graph is $y = -(x^2 - x + 1)$

$= -x^2 + x - 1$

(vii) Reflection in the y-axis means that f(x) is transformed into f(-x)

New graph is $y = (-x)^2 - (-x) + 1$

$= x^2 + x + 1$

3. (i) Translation by 4 units in the negative y direction
(ii) Translation by 3 units in the positive x direction
(iii) Stretch scale factor 2 parallel to the y axis

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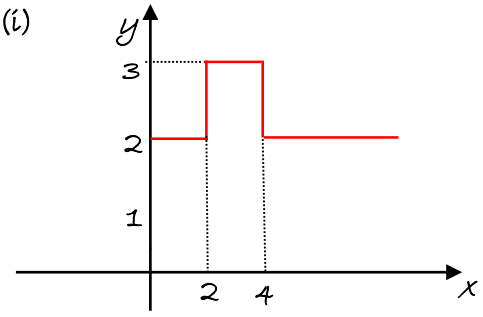
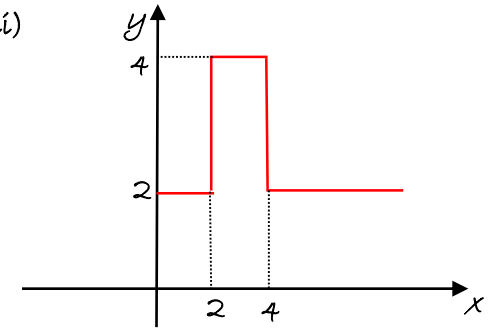
(iv) Translation of $\begin{pmatrix} -2 \\ -3 \end{pmatrix}$

(v) Reflection in the x-axis.

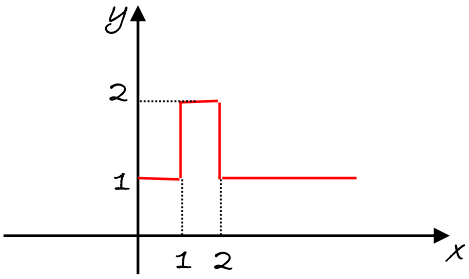
4. (i)



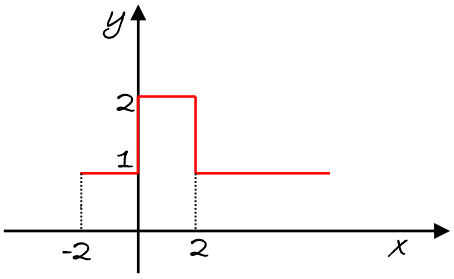
(ii)



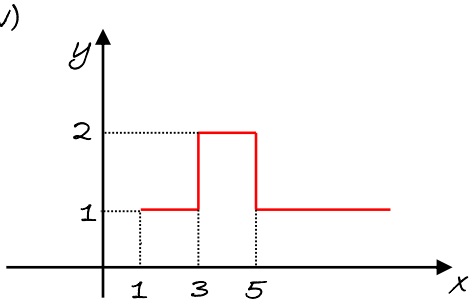
(iii)



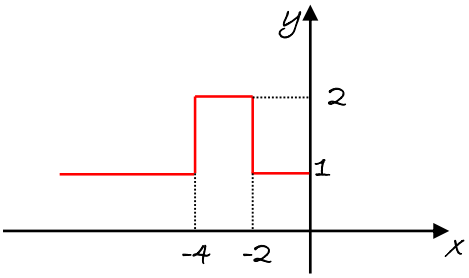
(iv)



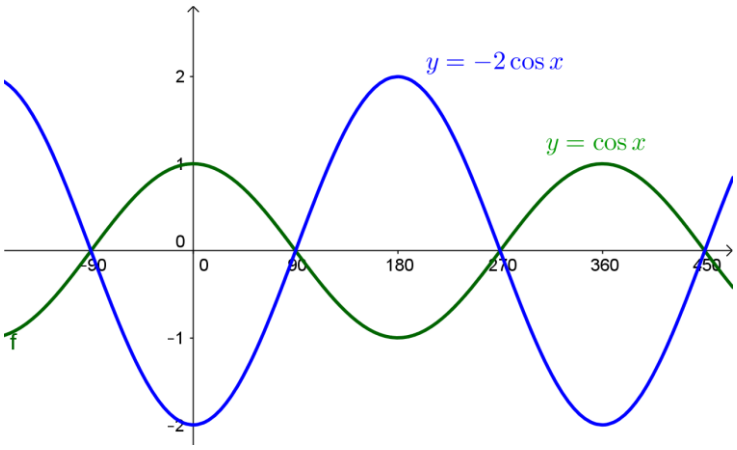
(v)



(vi)



5. (i)



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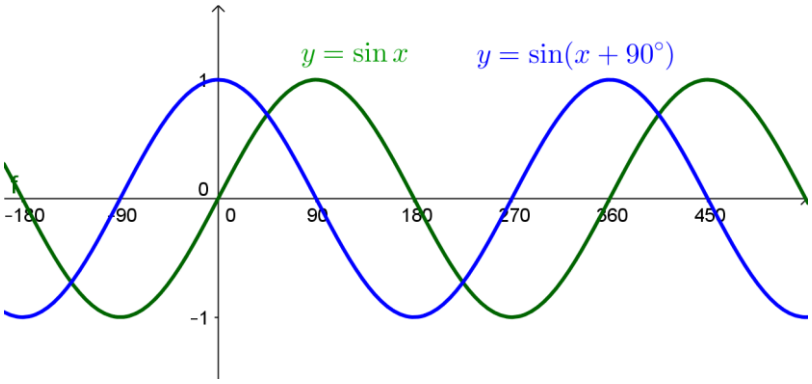
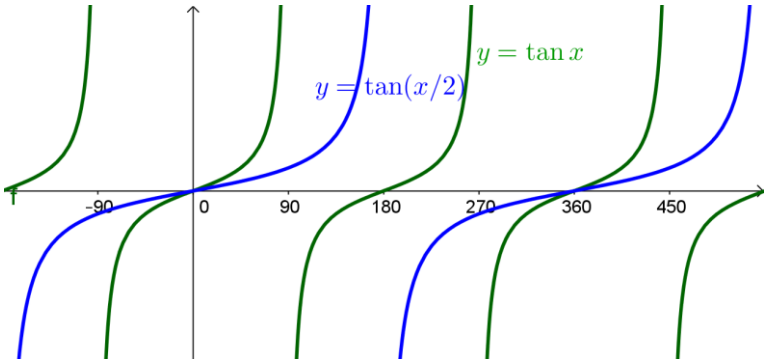
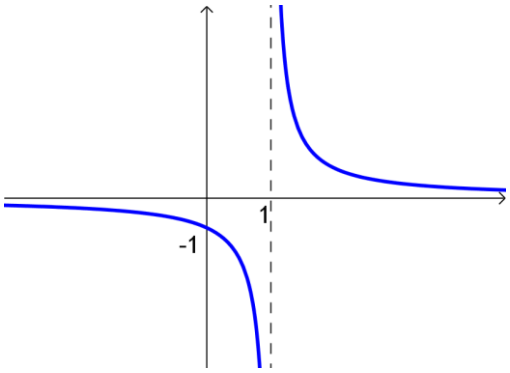
(ii)



(iii)



6. (i) $y = \frac{1}{x-1}$ - horizontal translation of $y = \frac{1}{x}$, 1 unit to the right



(ii) $y = \frac{1}{x} + 2$ - vertical translation of $y = \frac{1}{x}$, 2 units upwards

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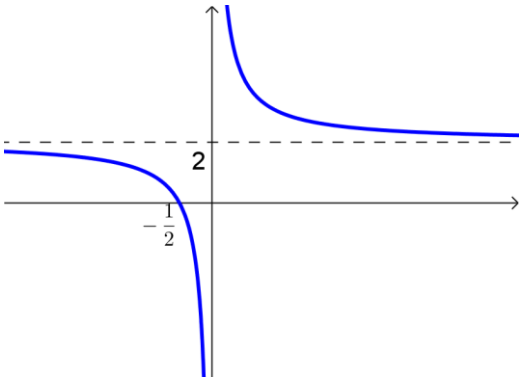
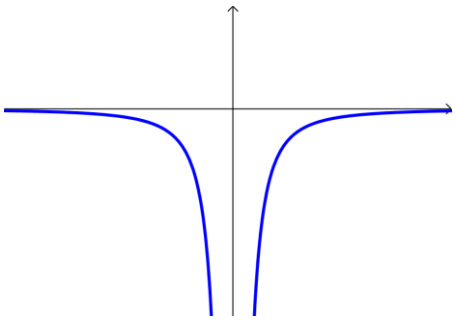


(iii) $y = -\frac{1}{x^2}$ - reflection of $y = \frac{1}{x^2}$ in the x-axis



(iv) $y = \frac{1}{(x+2)^2}$ - horizontal translation of $y = \frac{1}{x^2}$, 2 units to the left