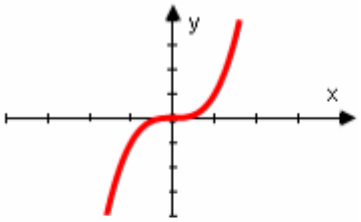
Transformation Of Functions Exam Questions MS (From OCR Legacy 4721)

Q1 (Jan 2005, Q3)

3(i)	$y = 5\sqrt{2x}$	M1		$\sqrt{2x}$ or $\sqrt{\frac{x}{2}}$ seen
		A1	2	$y = 5\sqrt{2x}$
(ii)	Translation $\begin{pmatrix} 0 \\ -3 \end{pmatrix}$	B1		Translation
		B1	2	$\begin{pmatrix} 0 \\ -3 \end{pmatrix}$ o.e.
			4	

Q2 (Jun 2005, Q3)

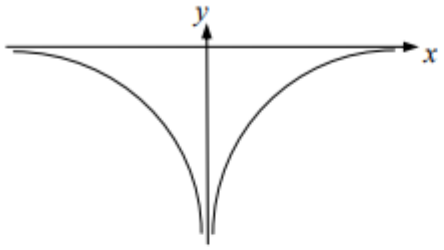
3 (i)		B1	1	Correct sketch showing point of inflection at origin
(ii)	Reflection in *x*-axis or reflection in *y*-axis	B1 B1	2	Reflection In *x*-axis or *y*=0 or *y*-axis or *x*=0
(iii)	$y = (x - p)^3$	M1		$y = (x \pm p)^3$
		A1	2 **5**	$y = (x - p)^3$

Q3 (Jan 2007, Q5)

5 (i)		M1		Reflection in either axis
		A1	2	Correct reflection in x axis
(ii)	(1, 3)	B1 B1	2	Correct x coordinate Correct y coordinate **SR** B1 for (3, 1)
(iii)	Translation 2 units in negative x direction	B1 B1	2	
			6	

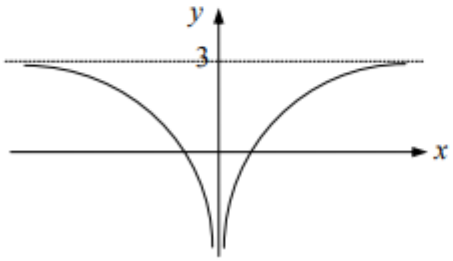
Q4 (Jun 2010, Q2)

(i)



B1*		Reasonably correct curve for $y=-\frac{1}{x^2}$ in 3rd and 4th quadrants only
B1 dep*	**2**	Very good curves in curve for $y=-\frac{1}{x^2}$ in 3rd and 4th quadrants **SC** If 0, very good single curve in either 3rd or 4th quadrant and nothing in other three quadrants. **B1**

(ii)



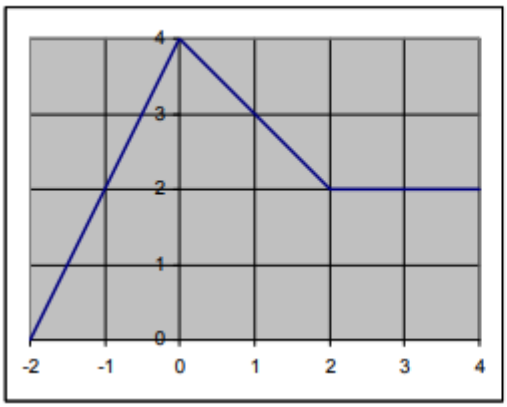
M1		Translation of their $y=-\frac{1}{x^2}$ vertically
A1	**2**	Reasonably correct curve, horizontal asymptote soi at $y=3$

(iii) $y=-\frac{2}{x^2}$ **B1** **1**

5

Q5 (Jan 2010, Q2)

(i)



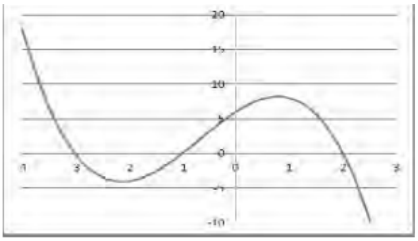
B1		For $x<0$, straight line joining (–2, 0) and (0, 4)
B1	**2**	For $x>0$, line joining (0,4) to (2, 2) and horizontal line joining (2,2) and (4,2)

(ii) Translation
1 unit right parallel to x axis

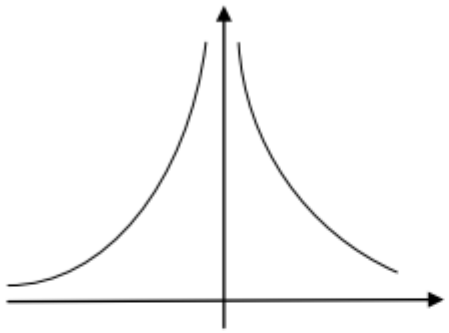
B1		
B1	**2**	Allow: 1 unit right, 1 along the x axis, 1 in x **direction**, allow vector notation e.g. $\begin{pmatrix}1\\0\end{pmatrix}$, 1 unit horizontally

4

Q6, (Jan 2013, Q3)

(i)			B1 B1 B1 **[3]**	-ve cubic with 3 distinct roots (0, 6) labelled or indicated on *y*-axis – seen elsewhere not enough (-3, 0), (-1, 0) and (2, 0) labelled or indicated on *x*-axis and no other *x*-intercepts.	Must not stop at x-axis. Condone errors in curvature at the extremes unless extra turning point(s)/root(s) clearly implied. **Must have a curve for 2nd and 3rd marks** Do not allow final B1 if shown as repeated root(s)
(ii)		Reflection in the *y* axis	B1 B1 **[2]**	Not mirrored/flipped etc. or $x = 0$. No/through/along etc. Must be "in". Cannot get 2nd B1 without some indication of a reflection e.g. flip etc. Do not **ISW** if contradictory statement seen	**Alt** Stretch (scale) factor –1 **B1** parallel to the *x* axis for **B1** **Must be a single transformation for any marks**

Q7 (Jun 2013, Q5)

(i)			B1 B1 **[2]**	Excellent curve for $y = \frac{2}{x^2}$ in either quadrant Excellent curve for $y = \frac{2}{x^2}$ in other quadrant and no more. **SC B1** Reasonably correct curves in 1st and 2nd quadrants and no more
(ii)		$y = \frac{2}{(x+5)^2}$	M1 A1 **[2]**	$\frac{2}{(x+5)^2}$ or $\frac{2}{(x-5)^2}$ seen Fully correct, must include "$y =$" or "f(x) ="
(iii)		Stretch scale factor $\frac{1}{2}$ parallel to *y*-axis	B1 B1 **[2]**	Or "stretched" etc; **do not accept** squashed, compressed etc. **oe** e.g. scale factor $1/\sqrt{2}$ parallel to *x*-axis

Q8 (OCR 4722, Jun 2016, Q8) [Modified]

(i)		2 (units) in the positive x-direction	M1	Correct direction	Identify that the translation is in the x-direction (either positive or negative, so M1 for eg '2 in negative x-direction') Allow any terminology as long as intention is clear, such as in/on/along the x-axis Ignore the magnitude
			A1	Fully correct description	Must have correct magnitude and correct direction, using precise language - such as 'in the x-direction', 'parallel to the x-axis', 'horizontally' or 'to the right' A0 for in/on/along the x-axis etc Allow M1A1 for '2 in the x-direction' as positive is implied A0 for 'factor 2' 'Units' is not required, but A0 for 'places', 'spaces', 'squares' etc Allow in vector notation as well, so M1 for $\binom{k}{0}$ and M1A1 for $\binom{2}{0}$
			[2]		
(ii)		sf $\frac{1}{9}$ in the y-direction	M1	Correct direction, with sf of $\frac{1}{9}$ or 9	Identify that the stretch is in the y-direction, with a scale factor of either $\frac{1}{9}$ or 9 (or equiv in index notation) Allow just $\frac{1}{9}$ or 9, with no mention of 'scale factor' Allow exact decimal equiv for $\frac{1}{9}$ Allow any terminology as long as the intention is clear, such as in/on/along the y-axis
			A1	Fully correct description	Must have correct scale factor and correct direction, using precise language - such as 'in the y-direction', 'parallel to the y-axis' or 'vertically' A0 for in/on/along the y-axis etc Must now have 'scale factor' or 'factor' Allow 'positive y-direction' (not incorrect as graph is wholly above x-axis)
			[2]		
(iii)		 intersect at $(0, \frac{1}{9})$	B1*	Correct sketch, in both quadrants	Curve must tend towards the negative x-axis, but not touch or cross it, nor a significant flick back upwards If from plotted points then there must be enough of the graph shown to demonstrate the correct general shape, including the negative x-axis being an asymptote Ignore any numerical values given
			B1d*	State $(0, \frac{1}{9})$	Condone $x = 0$, $y = \frac{1}{9}$ as an alternative, but $x = 0$ must be stated explicitly rather than implied Allow no brackets around the coordinates Allow exact decimal equiv for $\frac{1}{9}$ Allow just $\frac{1}{9}$ as long as marked on the y-axis Allow BOD for $(\frac{1}{9}, 0)$ on y-axis, but not if just stated Just being seen in a table of values is not sufficient Ignore any other labelled coordinates
			[2]		