# Multiple Transformations Of Functions Exam Questions (From OCR 4723)

**Q1, (Jun 2005, Q9i [Modified])**

The function f is defined by $f(x) = \sqrt{(mx + 7)} - 4$, where $x \geqslant -\frac{7}{m}$ and $m$ is a positive constant.

**(i)** A sequence of transformations maps the curve $y = \sqrt{x}$ to the curve $y = f(x)$. Give details of these transformations. [4]

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**Q2, (Jun 2009, Q8i)**

Give details of the pair of transformations which transforms the curve $y = \ln x$ to the curve $y = 2\ln(x - 6)$. **[3]**

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**Q3, (Jan 2007, Q7i,ii)**

The curve $y = \ln x$ is transformed to the curve $y = \ln\left(\frac{1}{2}x - a\right)$ by means of a translation followed by a stretch. It is given that $a$ is a positive constant.

**(i)** Give full details of the translation and stretch involved. [2]

**(ii)** Sketch the graph of $y = \ln\left(\frac{1}{2}x - a\right)$. [2]

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**Q4, (Jan 2008, Q6i)**

Give details of the pair of geometrical transformations which transforms the graph of $y = -\sin^{-1}(x - 1)$ to the graph of $y = \sin^{-1} x$. [3]

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**Q5, (Jan 2010, Q8i)**

The curve $y = \sqrt{x}$ can be transformed to the curve $y = \sqrt{2x + 3}$ by means of a stretch parallel to the $y$-axis followed by a translation. State the scale factor of the stretch and give details of the translation. **[3]**

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**Q6, (Jun 2010, Q2)**

The transformations R, S and T are defined as follows.

R : reflection in the $x$-axis
S : stretch in the $x$-direction with scale factor 3
T : translation in the positive $x$-direction by 4 units

**(i)** The curve $y = \ln x$ is transformed by R followed by T. Find the equation of the resulting curve. **[2]**

**(ii)** Find, in terms of S and T, a sequence of transformations that transforms the curve $y = x^3$ to the curve $y = \left(\frac{1}{9}x - 4\right)^3$. You should make clear the order of the transformations. **[2]**

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**Q7, (Jun 2011, Q2)**

The curve $y = \ln x$ is transformed by:

a reflection in the $x$-axis,
followed by a stretch with scale factor 3 parallel to the $y$-axis,
followed by a translation in the positive $y$-direction by $\ln 4$.

Find the equation of the resulting curve, giving your answer in the form $y = \ln(f(x))$. **[4]**

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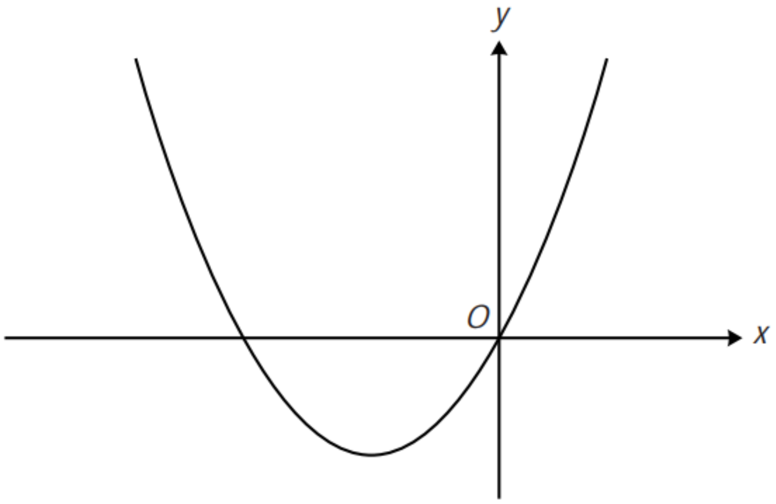
**Q8, (Jan 2012, Q9)**




The function f is defined for all real values of $x$ by

$$f(x) = k(x^2 + 4x),$$

where $k$ is a positive constant. The diagram shows the curve with equation $y = f(x)$.

**(i)** The curve $y = x^2$ can be transformed to the curve $y = f(x)$ by the following sequence of transformations:
a translation parallel to the $x$-axis,
a translation parallel to the $y$-axis,
a stretch.
Give details, in terms of $k$ where appropriate, of these transformations. **[5]**

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**Q9, (Jun 2006, Q8i,ii) [Note: Requires knowledge of the form $Rcos(\theta - \alpha)$]**

**(i)** Express $5\cos x + 12\sin x$ in the form $R\cos(x - \alpha)$, where $R > 0$ and $0° < \alpha < 90°$. [3]

**(ii)** Hence give details of a pair of transformations which transforms the curve $y = \cos x$ to the curve $y = 5\cos x + 12\sin x$. [3]

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**Q10, (Jan 2009, Q7) [Note: Parts i/ii require knowledge of the modulus function]**

The diagram shows the curve $y = e^{kx} - a$, where $k$ and $a$ are constants.

**(i)** Give details of the pair of transformations which transforms the curve $y = e^x$ to the curve $y = e^{kx} - a$. **[3]**

**(ii)** Sketch the curve $y = |e^{kx} - a|$. **[2]**

**(iii)** Given that the curve $y = |e^{kx} - a|$ passes through the points $(0, 13)$ and $(\ln 3, 13)$, find the values of $k$ and $a$. **[4]**

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