# Core 1: Quadratics

Past Paper Questions
2006 - 2013

Name:

January 2006

**3** (a) (i) Express $x^2 - 4x + 9$ in the form $(x - p)^2 + q$, where $p$ and $q$ are integers. *(2 marks)*

(ii) Hence, or otherwise, state the coordinates of the minimum point of the curve with equation $y = x^2 - 4x + 9$. *(2 marks)*

(b) The line $L$ has equation $y + 2x = 12$ and the curve $C$ has equation $y = x^2 - 4x + 9$.

(i) Show that the $x$-coordinates of the points of intersection of $L$ and $C$ satisfy the equation

$$x^2 - 2x - 3 = 0$$ *(1 mark)*

(ii) Hence find the coordinates of the points of intersection of $L$ and $C$. *(4 marks)*

**4** The quadratic equation $x^2 + (m + 4)x + (4m + 1) = 0$, where $m$ is a constant, has equal roots.

(a) Show that $m^2 - 8m + 12 = 0$. *(3 marks)*

(b) Hence find the possible values of $m$. *(2 marks)*

June 2006

**2** (a) Express $x^2 + 8x + 19$ in the form $(x + p)^2 + q$, where $p$ and $q$ are integers. *(2 marks)*

(b) Hence, or otherwise, show that the equation $x^2 + 8x + 19 = 0$ has no real solutions. *(2 marks)*

(c) Sketch the graph of $y = x^2 + 8x + 19$, stating the coordinates of the minimum point and the point where the graph crosses the $y$-axis. *(3 marks)*

(d) Describe geometrically the transformation that maps the graph of $y = x^2$ onto the graph of $y = x^2 + 8x + 19$. *(3 marks)*

January 2007

*All part of other questions*

June 2007

**3** (a) (i) Express $x^2 + 10x + 19$ in the form $(x + p)^2 + q$, where $p$ and $q$ are integers. *(2 marks)*

(ii) Write down the coordinates of the vertex (minimum point) of the curve with equation $y = x^2 + 10x + 19$. *(2 marks)*

(iii) Write down the equation of the line of symmetry of the curve $y = x^2 + 10x + 19$. *(1 mark)*

(iv) Describe geometrically the transformation that maps the graph of $y = x^2$ onto the graph of $y = x^2 + 10x + 19$. *(3 marks)*

(b) Determine the coordinates of the points of intersection of the line $y = x + 11$ and the curve $y = x^2 + 10x + 19$. *(4 marks)*

January 2008

**5** (a) Factorise $9 - 8x - x^2$. *(2 marks)*

(b) Show that $25 - (x + 4)^2$ can be written as $9 - 8x - x^2$. *(1 mark)*

(c) A curve has equation $y = 9 - 8x - x^2$.

(i) Write down the equation of its line of symmetry. *(1 mark)*

(ii) Find the coordinates of its vertex. *(2 marks)*

(iii) Sketch the curve, indicating the values of the intercepts on the $x$-axis and the $y$-axis. *(3 marks)*

June 2008

**1** The straight line $L$ has equation $y = 3x - 1$ and the curve $C$ has equation

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

(a) Sketch on the same axes the line $L$ and the curve $C$, showing the values of the intercepts on the $x$-axis and the $y$-axis. *(5 marks)*

(b) Show that the $x$-coordinates of the points of intersection of $L$ and $C$ satisfy the equation $x^2 - x - 2 = 0$. *(2 marks)*

(c) Hence find the coordinates of the points of intersection of $L$ and $C$. *(4 marks)*

**4** (a) Express $x^2 - 3x + 4$ in the form $(x - p)^2 + q$, where $p$ and $q$ are rational numbers. *(2 marks)*

(b) Hence write down the minimum value of the expression $x^2 - 3x + 4$. *(1 mark)*

(c) Describe the geometrical transformation that maps the graph of $y = x^2$ onto the graph of $y = x^2 - 3x + 4$. *(3 marks)*

January 2009

**4** (a) (i) Express $x^2 + 2x + 5$ in the form $(x + p)^2 + q$, where $p$ and $q$ are integers. *(2 marks)*

(ii) Hence show that $x^2 + 2x + 5$ is always positive. *(1 mark)*

(b) A curve has equation $y = x^2 + 2x + 5$.

(i) Write down the coordinates of the minimum point of the curve. *(2 marks)*

(ii) Sketch the curve, showing the value of the intercept on the $y$-axis. *(2 marks)*

(c) Describe the geometrical transformation that maps the graph of $y = x^2$ onto the graph of $y = x^2 + 2x + 5$. *(3 marks)*

June 2009

**6** (a) (i) Express $x^2 - 8x + 17$ in the form $(x - p)^2 + q$, where $p$ and $q$ are integers. *(2 marks)*

(ii) Hence write down the minimum value of $x^2 - 8x + 17$. *(1 mark)*

(iii) State the value of $x$ for which the minimum value of $x^2 - 8x + 17$ occurs. *(1 mark)*

(b) The point $A$ has coordinates $(5, 4)$ and the point $B$ has coordinates $(x, 7 - x)$.

(i) Expand $(x - 5)^2$. *(1 mark)*

(ii) Show that $AB^2 = 2(x^2 - 8x + 17)$. *(3 marks)*

(iii) Use your results from part (a) to find the minimum value of the distance $AB$ as $x$ varies. *(2 marks)*

January 2010

**5** (a) Express $(x-5)(x-3)+2$ in the form $(x-p)^2+q$, where $p$ and $q$ are integers. *(3 marks)*

(b) (i) Sketch the graph of $y=(x-5)(x-3)+2$, stating the coordinates of the minimum point and the point where the graph crosses the $y$-axis. *(3 marks)*

(ii) Write down an equation of the tangent to the graph of $y=(x-5)(x-3)+2$ at its vertex. *(2 marks)*

(c) Describe the geometrical transformation that maps the graph of $y=x^2$ onto the graph of $y=(x-5)(x-3)+2$. *(3 marks)*

June 1010

*All part of other questions*

January 2011

**7 (a) (i)** Express $4-10x-x^2$ in the form $p-(x+q)^2$. *(2 marks)*

**(ii)** Hence write down the equation of the line of symmetry of the curve with equation $y=4-10x-x^2$. *(1 mark)*

**(b)** The curve $C$ has equation $y=4-10x-x^2$ and the line $L$ has equation $y=k(4x-13)$, where $k$ is a constant.

**(i)** Show that the $x$-coordinates of any points of intersection of the curve $C$ with the line $L$ satisfy the equation

$$x^2+2(2k+5)x-(13k+4)=0$$ *(1 mark)*

June 2011

**4 (a)** Express $x^2+5x+7$ in the form $(x+p)^2+q$, where $p$ and $q$ are rational numbers. *(3 marks)*

**(b)** A curve has equation $y=x^2+5x+7$.

**(i)** Find the coordinates of the vertex of the curve. *(2 marks)*

**(ii)** State the equation of the line of symmetry of the curve. *(1 mark)*

**(iii)** Sketch the curve, stating the value of the intercept on the $y$-axis. *(3 marks)*

**(c)** Describe the geometrical transformation that maps the graph of $y=x^2$ onto the graph of $y=x^2+5x+7$. *(3 marks)*

January 2012

**2 (a)** Factorise $x^2 - 4x - 12$. *(1 mark)*

**(b)** Sketch the graph with equation $y = x^2 - 4x - 12$, stating the values where the curve crosses the coordinate axes. *(4 marks)*

**(c) (i)** Express $x^2 - 4x - 12$ in the form $(x - p)^2 - q$, where $p$ and $q$ are positive integers. *(2 marks)*

**(ii)** Hence find the minimum value of $x^2 - 4x - 12$. *(1 mark)*

**(d)** The curve with equation $y = x^2 - 4x - 12$ is translated by the vector $\begin{bmatrix} -3 \\ 2 \end{bmatrix}$.

Find an equation of the new curve. You need not simplify your answer. *(2 marks)*

June 2012

**5 (a) (i)** Express $x^2 - 3x + 5$ in the form $(x - p)^2 + q$. *(2 marks)*

**(ii)** Hence write down the equation of the line of symmetry of the curve with equation $y = x^2 - 3x + 5$. *(1 mark)*

January 2013

**4 (a) (i)** Express $x^2 - 6x + 11$ in the form $(x - p)^2 + q$. *(2 marks)*

**(ii)** **Use the result from part (a)(i)** to show that the equation $x^2 - 6x + 11 = 0$ has no real solutions. *(2 marks)*

**(b)** A curve has equation $y = x^2 - 6x + 11$.

**(i)** Find the coordinates of the vertex of the curve. *(2 marks)*

**(ii)** Sketch the curve, indicating the value of $y$ where the curve crosses the $y$-axis. *(3 marks)*

**(iii)** Describe the geometrical transformation that maps the curve with equation $y = x^2 - 6x + 11$ onto the curve with equation $y = x^2$. *(3 marks)*

**5 (a) (i)** Express $2x^2 + 6x + 5$ in the form $2(x + p)^2 + q$, where $p$ and $q$ are rational numbers. *(2 marks)*

**(ii)** Hence write down the minimum value of $2x^2 + 6x + 5$. *(1 mark)*

**(b)** The point $A$ has coordinates $(-3, 5)$ and the point $B$ has coordinates $(x, 3x + 9)$.

**(i)** Show that $AB^2 = 5(2x^2 + 6x + 5)$. *(3 marks)*

**(ii)** Use your result from part **(a)(ii)** to find the minimum value of the length $AB$ as $x$ varies, giving your answer in the form $\frac{1}{2}\sqrt{n}$, where $n$ is an integer. *(2 marks)*