C1 Coordinate Geometry and Transformations

1. June 2010 qu.9

(i) The line joining the points $A(4, 5)$ and $B(p, q)$ has mid-point $M(-1, 3)$. Find p and q. [3]

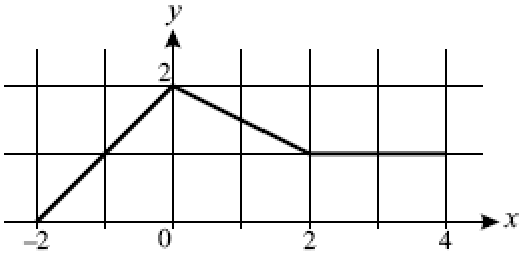
AB is the diameter of a circle.

(ii) Find the radius of the circle. [2]

(iii) Find the equation of the circle, giving your answer in the form $x^2 + y^2 + ax + by + c = 0$. [3]

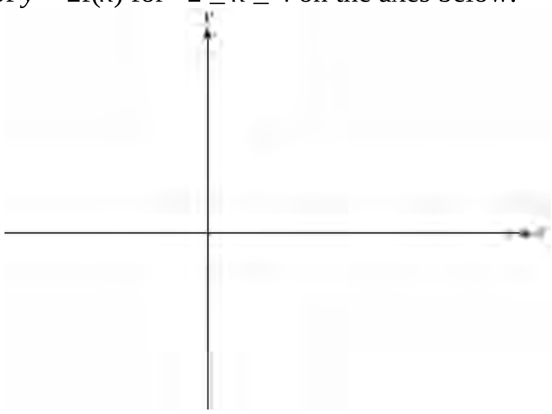
(iv) Find an equation of the tangent to the circle at the point (4, 5). [5]

2. Jan 2010 qu.2



The graph of $y = f(x)$ for $-2 \le x \le 4$ is shown above.

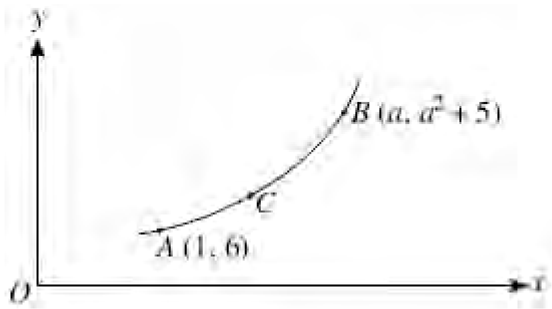
(i) Sketch the graph of $y = 2f(x)$ for $-2 \le x \le 4$ on the axes below.



[2]

(ii) Describe the transformation which transforms the graph of $y = f(x)$ to the graph of $y = f(x - 1)$. [2]

3. Jan 2010 qu.6



Not to scale

The diagram shows part of the curve $y = x^2 + 5$. The point A has coordinates (1, 6). The point B has coordinates $(a, a^2 + 5)$, where a is a constant greater than 1.

The point C is on the curve between A and B.

(i) Find by differentiation the value of the gradient of the curve at the point A. [2]

(ii) The line segment joining the points A and B has gradient 2.3. Find the value of a. [4]

(iii) State a possible value for the gradient of the line segment joining the points A and C. [1]

4. June 2009 qu.8

A circle has equation $x^2 + y^2 + 6x - 4y - 4 = 0$.

(i) Find the centre and radius of the circle. [3]

(ii) Find the coordinates of the points where the circle meets the line with equation $y = 3x + 4$. [6]

5. June 2009 qu.6

(i) Sketch the curve $y = -\sqrt{x}$. [2]

(ii) Describe fully a transformation that transforms the curve $y = -\sqrt{x}$ to the curve $y = 5 - \sqrt{x}$. [2]

(iii) The curve $y = -\sqrt{x}$ is stretched by a scale factor of 2 parallel to the x-axis. State the equation of the curve after it has been stretched. [2]

6. June 2009 qu.7

(i) Express $x^2 - 5x + \frac{1}{4}$ in the form $(x - a)^2 - b$. [3]

(ii) Find the centre and radius of the circle with equation $x^2 + y^2 - 5x + \frac{1}{4} = 0$. [3]

7. June 2009 qu.9

A is the point (4, –3) and B is the point (–1, 9).

(i) Calculate the length of AB. [2]

(ii) Find the coordinates of the mid-point of AB. [2]

(iii) Find the equation of the line through (1, 3) which is parallel to AB, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. [4]

8. Jan 2009 qu.4

(i) Sketch the curve $y = \frac{1}{x^2}$. [2]

(ii) The curve $y = \frac{1}{x^2}$ is translated by 3 units in the negative x-direction. State the equation of the curve after it has been translated. [2]

(iii) The curve $y = \frac{1}{x^2}$ is stretched parallel to the y-axis with scale factor 4 and, as a result, the point $P(1, 1)$ is transformed to the point Q. State the coordinates of Q. [2]

9. Jan 2009 qu.7

The line with equation $3x + 4y - 10 = 0$ passes through point $A(2, 1)$ and point $B(10, k)$.

(i) Find the value of k. [2]

(ii) Calculate the length of AB. [2]

A circle has equation $(x - 6)^2 + (y + 2)^2 = 25$.

(iii) Write down the coordinates of the centre and the radius of the circle. [2]

(iv) Verify that AB is a diameter of the circle. [2]

10. June 2008 qu.2

(i) The curve $y = x^2$ is translated 2 units in the positive x-direction. Find the equation of the curve after it has been translated. [2]

(ii) The curve $y = x^3 - 4$ is reflected in the x-axis. Find the equation of the curve after it has been reflected. [1]

11. June 2008 qu.9

(i) Find the equation of the circle with radius 10 and centre (2, 1), giving your answer in the form $x^2 + y^2 + ax + by + c = 0$. [3]

(ii) The circle passes through the point (5, k) where $k > 0$. Find the value of k in the form $p + \sqrt{q}$. [3]

(iii) Determine, showing all working, whether the point (−3, 9) lies inside or outside the circle. [3]

(iv) Find an equation of the tangent to the circle at the point (8, 9). [5]

12. Jan 2008 qu.2

(i) Write down the equation of the circle with centre (0, 0) and radius 7. [1]

(ii) A circle with centre (3, 5) has equation $x^2 + y^2 - 6x - 10y - 30 = 0$. Find the radius of the circle. [2]

13. Jan 2008 qu.7

(i) Find the gradient of the line l which has equation $x + 2y = 4$. [1]

(ii) Find the equation of the line parallel to l which passes through the point (6, 5), giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. [3]

(iii) Solve the simultaneous equations $y = x^2 + x + 1$ and $x + 2y = 4$. [4]

14. Jan 2008 qu.5

(i) Sketch the curve $y = x^3 + 2$. **[2]**

(ii) Sketch the curve $y = 2\sqrt{x}$. **[2]**

(iii) Describe a transformation that transforms the curve $y = 2\sqrt{x}$ to the curve $y = 3\sqrt{x}$. **[3]**

15. Jan 2008 qu.9

The points A and B have coordinates (−5, −2) and (3, 1) respectively.

(i) Find the equation of the line AB, giving your answer in the form $ax + by + c = 0$. **[3]**

(ii) Find the coordinates of the mid-point of AB. **[2]**

The point C has coordinates (−3, 4).

(iii) Calculate the length of AC, giving your answer in simplified surd form. **[3]**

(iv) Determine whether the line AC is perpendicular to the line BC, showing all your working. **[4]**

16. June 2007 qu.9

The circle with equation $x^2 + y^2 - 6x - k = 0$ has radius 4.

(i) Find the centre of the circle and the value of k. [4]

The points A (3, a) and B (–1, 0) lie on the circumference of the circle, with $a > 0$.

(ii) Calculate the length of AB, giving your answer in simplified surd form. [5]

(iii) Find an equation for the line AB. [3]

17. Jan 2007 qu.9

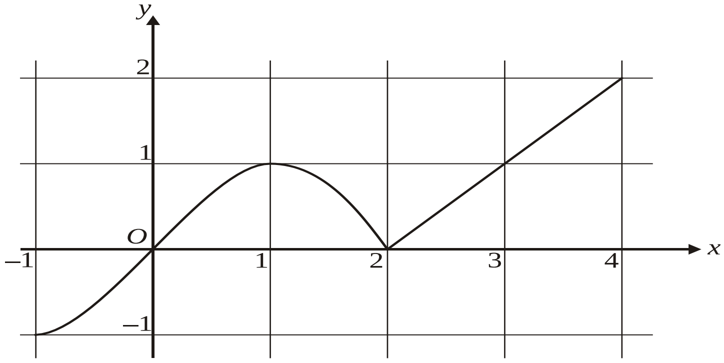
A is the point (2, 7) and B is the point (−1, −2).

(i) Find the equation of the line through A parallel to the line $y = 4x - 5$, giving your answer in the form $y = mx + c$. [3]

(ii) Calculate the length of AB, giving your answer in simplified surd form. [3]

(iii) Find the equation of the line which passes through the mid-point of AB and which is perpendicular to AB. Give your answer in the form $ax + by + c = 0$, where a ,b and c are integers. [6]

18. Jan 2007 qu.5



The graph of $y = \mathrm{f}(x)$ for $-1 \le x \le 4$ is shown above.

(i) Sketch the graph of $y = -\mathrm{f}(x)$ for $-1 \le x \le 4$. **[2]**

(ii) The point P (1, 1) on $y = \mathrm{f}(x)$ is transformed to the point Q on $y = 3\mathrm{f}(x)$.
State the coordinates of Q. **[2]**

(iii) Describe the transformation which transforms the graph of $y = \mathrm{f}(x)$ to the graph of $y = \mathrm{f}(x + 2)$. **[2]**

19. June 2006 qu.9
The points A and B have coordinates (4, –2) and (10, 6) respectively. C is the mid-point of AB.
Find
(i) the coordinates of C, [2]
(ii) the length of AC, [2]
(iii) the equation of the circle that has AB as a diameter, [3]
(iv) the equation of the tangent to the circle in part (iii) at the point A, giving your answer in the form $ax + by = c$. [5]

20. Jan 2006 qu.9
The points A, B and C have coordinates (5, 1), (p, 7) and (8, 2) respectively.
(i) Given that the distance between points A and B is twice the distance between points A and C, calculate the possible values of p. [7]
(ii) Given also that the line passing through A and B has equation $y = 3x - 14$, find the coordinates of the mid-point of AB. [4]

21. June 2005 qu.3
(i) Sketch the curve $y = x^3$. **[1]**
(ii) Describe a transformation that transforms the curve $y = x^3$ to the curve $y = -x^3$. **[2]**
(iii) The curve $y = x^3$ is translated by p units, parallel to the x-axis. State the equation of the curve after it has been transformed. **[2]**

22. June 2005 qu.8
(i) Describe completely the curve $x^2 + y^2 = 25$. [2]
(ii) Find the coordinates of the points of intersection of the curve $x^2 + y^2 = 25$ and the line $2x + y - 5 = 0$. [6]

23. June 2005 qu.9
(i) Find the gradient of the line l_1 which has equation $4x - 3y + 5 = 0$. [1]
(ii) Find an equation of the line l_2, which passes through the point (1, 2) and which is perpendicular to the line l_1, giving your answer in the form $ax + by + c = 0$. [4]

The line l_1 crosses the x-axis at P and the line l_2 crosses the y-axis at Q.
(iii) Find the coordinates of the mid-point of PQ. [3]
(iv) Calculate the length of PQ, giving your answer in the form $\frac{\sqrt{a}}{b}$, where a and b are integers. [3]