R Jones

Core 1 – Assignment 1

(1). Simplify $\dfrac{11-2\sqrt{10}}{\sqrt{10}-2}$,
expressing your answer in surd form. [4]

(P1 – Jan 2005)

(2). Simplify $\dfrac{2-\sqrt{5}}{\sqrt{5}+1}$,
expressing your answer in surd form. [4]

(P1 – Nov 2004)

(3). Simplify $\dfrac{4\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}$,
expressing your answer in surd form. [4]

(P1 – May 2004)

(4). Simplify $\dfrac{2\sqrt{7}+3}{\sqrt{7}+2}$,

expressing your answer in surd form. [4]

(P1 – Nov 2003)

(5). Simplify $\dfrac{2\sqrt{5}-\sqrt{2}}{\sqrt{5}+\sqrt{2}}$,
expressing your answer in surd form. [4]

(P1 – May 2003)

(6). Simplify $\dfrac{\sqrt{5}+3}{\sqrt{5}-1}$,
expressing your answer in surd form. [4]

(P1 – Jan 2003)

(7). Simplify $\dfrac{5-\sqrt{7}}{\sqrt{7}+1}$,

expressing your answer in surd form. [4]

(P1 – Nov 2002)

(8). Simplify $\dfrac{3\sqrt{3}-6}{2\sqrt{3}+3}$,
expressing your answer in surd form. [4]

(P1 – May 2002)

R Jones

Core 1 – Assignment 2

(9). Express $2x^2 - 8x + 29$ in the form $a(x - b)^2 + c$, where the values of the constants a, b and c are to be determined.
Hence sketch the graph of $y = 2x^2 - 8x + 29$, indicating the coordinates of the stationary point. [5]

(P1 – Jan 2005)

(10). Write $5 + 6x - x^2$ in the form $a - (x - b)^2$, where a and b are to be determined. Hence find the greatest value of $5 + 6x - x^2$. [4]

(P1 – Nov 2004)

(11). In the quadratic expression

$$f(x) = x^2 - 6kx + 4,$$

k is a positive constant.

(a) Express $f(x)$ in the form $(x - a)^2 + b$, giving the values of a and b in terms of k. [3]

(P1 – May 2004)

(12). (a) Express $3x^2 - 12x + 13$ in the form $a(x + b)^2 + c$, where the values of a, b and c are to be determined. [3]

(b) Sketch the graph of $y = 3x^2 - 12x + 13$. [2]

(P1 – Nov 2003)

(13). Given that the quadratic equation $2x^2 + 2kx + 12 - k = 0$ has equal roots, find the possible values of k. [4]

(P1 – May 2003)

(14). Express $2x^2 - 4x + 9$ in the form $a(x + b)^2 + c$, where the values of a, b and c are to be determined.
Hence, or otherwise, show that $2x^2 - 4x + 9$ is positive for all values of x. [5]

(P1 – Jan 2003)

(15). Prove that the quadratic equation

$$kx^2 + (2k+3)x + k + 3 = 0$$

has two distinct real roots for all values of k. [4]

(P1 – Nov 2002)

(16). Given that the quadratic equation

$$(1 - k)x^2 + 8x + 1 - k = 0$$

has equal roots, find the possible values of k. [4]

(P1 – May 2002)

R Jones

Core 1 – Assignment 3

(17). The points A, B and C have coordinates (1, 3), (–2, –2), (–4, 6) respectively. The line through A perpendicular to BC meets BC at D.

(a) Show that the equation of BC is

$$4x + y + 10 = 0$$

and find the equation of AD. [7]

(b) Show that the coordinates of D are (–3, 2). [2]

(c) The line AD is extended to E so that D is the mid-point of AE. Find the coordinates of E and the length AE. [4]

(P1 – Jan 05)

(18). The points A, B, C have coordinates (–1, 3), (1, 7), (2, 4) respectively.

(a) The line L_1 is the perpendicular bisector of the line AB. Show that L_1 has equation

$$x + 2y - 10 = 0.$$ [6]

(b) The line L_2 passes through A and is parallel to BC. Find the equation of L_2. [3]

(c) Find the coordinates of D, the point of intersection of L_1 and L_2. [2]

(d) Show that $BC = AD$. [2]

(P1 – Nov 04)

(19). The points A, B, C, D have coordinates (2, 0), (5, 1), (7, 10), (–3, 5) respectively.

(a) Show that the lines AC and BD are perpendicular. [4]

(b) Show that the line AC has equation

$$2x - y - 4 = 0,$$

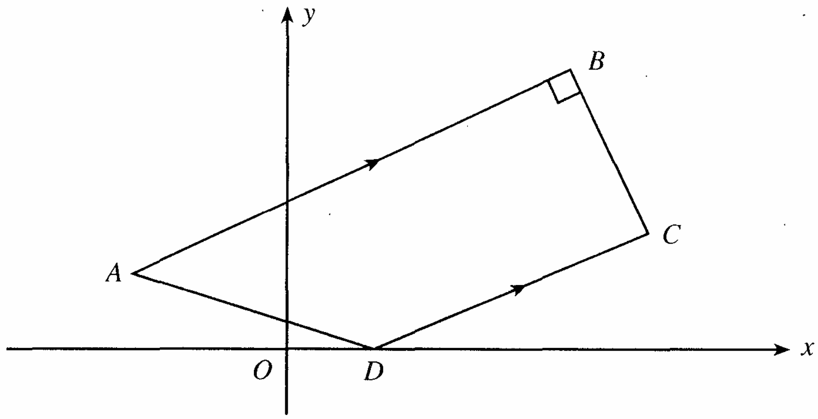
and find the equation of the line BD. [4]

(c) Find the coordinates of E, the point of intersection of the lines AC and BD. [2]

(d) Show that $AC = 5AE$. [3]

(P1 – May 04)

(20).



The diagram shows a trapezium $ABCD$ with AB parallel to DC and AB perpendicular to BC. The point C has coordinates (7,3) and D lies on the x-axis. The line AB has equation

$$x - 2y + 9 = 0.$$

(a) Find the gradient of the line AB. [1]

(b) Show that the equation of the line BC is

$$2x + y - 17 = 0,$$

and find the equation of CD. [6]

(c) Find the coordinates of B and D. [3]

(d) Show that the length of BC is two thirds the length of CD. [2]

(P1 – Nov 03)

(21). The points A and B have coordinates (1, –2), (5, 10), respectively. The mid-point of AB is C.

(a) Find

(i) the coordinates of C,

(ii) the gradient of AB . [3]

(b) The line L passes through the point C and is perpendicular to AB. Show that L has equation

$$x + 3y - 15 = 0.$$ [4]

(c) The line L intersects the x-axis at the point D.

(i) Find the coordinates of D. [1]

(ii) Calculate the size of $C\hat{A}D$. [4]

(P1 – Nov 2002)

(22). The points A and B have coordinates $(-2, 2)$ and $(6, 18)$, respectively. The mid-point of AB is C. The line through C perpendicular to AB intersects the x-axis at the point D.

(a) Find the gradient of AB. [2]

(b) Show that C has coordinates $(2, 10)$ and hence find the equation of CD. [4]

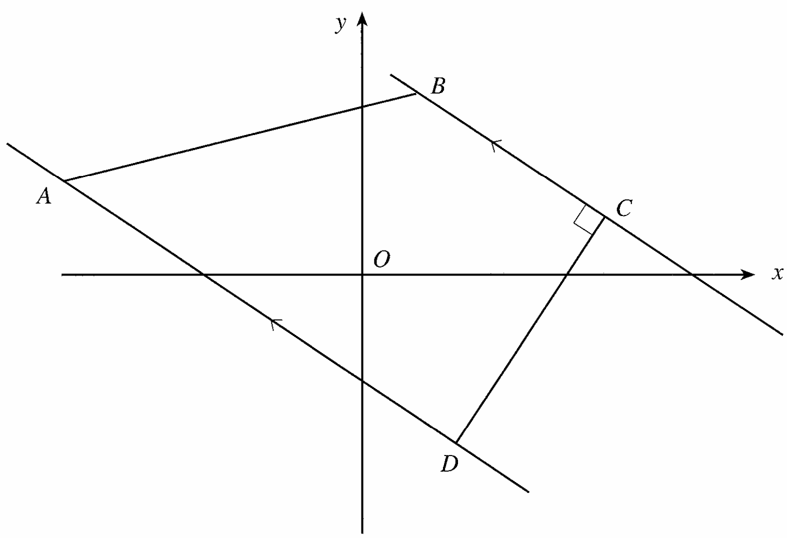
(c) Given that the point E has coordinates $(-10, 11)$, show that

(i) EC is parallel to AD,

(ii) $EC = \frac{1}{2} AD$. [7]

(P1 – May 03)

(23).



In the diagram, the points A, B, C have coordinates $(-10, 5)$, $(4, 7)$, $(8, 4)$ respectively.

(a) Find the gradient of BC. [2]

(b) Show that the line through A parallel to BC has equation

$$4y + 3x + 10 = 0.$$ [3]

(c) The line through C perpendicular to BC meets the line $4y + 3x + 10 = 0$ at D.

(i) Find the equation of CD.

(ii) Show that the coordinates of D are $(2, -4)$.

(iii) Find the area of the trapezium $ABCD$. [8]

(P1 – Jan 2003)

R Jones

Core 1 – Assignment 4

(1). (a) Given that the polynomial

$$4x^3 + 12x^2 + kx - 30$$

has a factor $x + 2$, show that $k = -7$. [2]

(b) Factorise $4x^3 + 12x^2 - 7x - 30$. [3]

(c) Find the remainder when $4x^3 + 12x^2 - 7x - 30$ is divided by $x - 2$. [2]

(P2 – Nov 2004)

(2). (a) Show that $x + 2$ is a factor of the polynomial

$$6x^3 + 11x^2 - 4x - 4$$

and find the other factors of the polynomial. [5]

(b) Find the remainder when $6x^3 + 11x^2 - 4x - 4$ is divided by $2x - 1$. [3]

(P2 – May 2004)

(3).

Given that $x - 1$ and $x + 2$ are factors of

$$f(x) = x^4 + ax^3 + bx^2 + 16x - 12,$$

show that $a = -4$ and find the value of b.

Solve the equation $f(x) = 0$. [9]

(P2 – Jan 2003)

(4).

The polynomial $2x^3 + px^2 + qx + 6$ has $x + 2$ as a factor. When the polynomial is divided by $x - 1$ the remainder is -6.

(a) Show that $p = -3$ and find the value of q. [4]

(b) Find the other factors of the polynomial. [3]

(P2 – May 2003)

(5). The polynomial $x^3 - x^2 + ax + b$ has $x + 2$ as a factor. When the polynomial is divided by $x + 1$, there is a remainder of 6.

(a) Show that $a = -4$ and find the value of b. [4]

(b) Find the other factors of the polynomial. [3]

(P2 – May 2002)

(6). The polynomial

$$2x^3 + 7x^2 + kx - 18$$

has $x + 3$ as a factor.

(a) Show that $k = -3$. [2]

(b) Solve the equation

$$2x^3 + 7x^2 - 3x - 18 = 0.$$ [4]

(c) Find the remainder when the polynomial is divided by $x + 1$. [2]

(P2 – Nov 2003)

(7). Given that $x + 2$ is a factor of

$$f(x) = x^3 - 7x + k,$$

(a) show that $k = -6$, [2]

(b) solve the equation $f(x) = 0$, [4]

(c) find the remainder when $f(x)$ is divided by $x + 3$. [2]

(P2 – Nov 2002)

(8). *(a)* Use the factor theorem to show that $(x - 1)$ is a factor of

$$2x^3 - 5x^2 + x + 2,$$

and solve the equation

$$2x^3 - 5x^2 + x + 2 = 0.$$ [4]

(P2 – June 2001)

Core 1 – Assignment 5

(9). (*a*) Use a counter-example to show that the statement

$$(a + b)^3 = a^3 + b^3$$

is false. [2]

(*b*) Write down the binomial expansion of $(a + b)^5$. [2]

(*c*) In the binomial expansion of $(a + 2x)^5$ the coefficient of x^2 is eight times the coefficient of x^4. Given that $a > 0$, find the value of a. [3]

(P2 – Nov 2004)

(10). (*a*) Write down the expansion of $(a + b)^3$. [2]

(*b*) Solve the equation

$$(2x + 3)^3 - (2x - 3)^3 = 60x^2 + 90.$$ [5]

(P2 – May 2004)

(11). (*a*) Write down the expansion of $(a + b)^4$. [2]

(*b*) Find the term independent of x in the expansion of $\left(2x + \frac{3}{x}\right)^4$. [3]

(P2 – Nov 2003)

(12). In the expansion of $(1 + x)^n$, where $n > 3$, the coefficient of x^4 is twice the coefficient of x^3. Find the value of n. [6]

(P2 – May 2003)

(13). Write down the expansion of $(a + b)^3$, evaluating all the coefficients.

Solve the equation

$$(2 + y)^3 + (2 - y)^3 = 784.$$ [5]

(P2 – Jan 2003)

(14). Given that

$$(1 + ax)^8 = 1 + 4x + bx^2 + cx^3 + \ldots,$$

find the values of a and b and show that $c = 7$.
Using your values of a, b and c, find the expansion of $(1 - 2x)(1 + ax)^8$ as far as the term in x^3. [8]

(P2 – Nov 2002)

R Jones

Core 1 – Assignment 6

(15). (a) Given that $y = x^2 + 5x - 2$, find $\frac{dy}{dx}$ from first principles. [5]

(b) Differentiate $\frac{3}{x} - 2x^{\frac{5}{2}}$ with respect to x. [2]

(P1 – Jan 2005)

(16). Differentiate $3x^2 - x + 5$ from first principles. [5]

(P1 – Nov 2004)

(17). (a) Given that $y = 3x^2 - 5x + 2$, find $\frac{dy}{dx}$ from first principles. [5]

(b) Differentiate $\frac{2}{x^2} + 7x^{\frac{1}{3}}$ with respect to x. [2]

(P1 – May 2004)

(18). (a) Differentiate $2x^2 - x + 7$ from first principles. [5]

(b) Differentiate $3\sqrt{x} - \frac{5}{x^2}$ with respect to x. [2]

(P1 – Nov 2003)

(19). (a) Given that $y = 2x^2 - 5x + 3$, find $\frac{dy}{dx}$ from first principles. [5]

(b) Differentiate $\frac{3}{x^2} + \frac{1}{\sqrt{x}} + x^{\frac{3}{2}}$ with respect to x. [3]

(P1 – May 2003)

(20). Given $y = 3x^2 - x + 2$, find $\frac{dy}{dx}$ from first principles. [5]

(P1 – Jan 2003)

(21). (a) Differentiate $2x^2 - 3x + 5$ from first principles. [5]

(b) Differentiate $5x^{\frac{1}{2}} - 7x^{-3}$ with respect to x. [2]

(P1 – Nov 2002)

R Jones

Core 1 – Assignment 7

(22). A curve C has equation

$$y = 6x^2 - x^3 + 2.$$

Find the coordinates of the stationary points of C and determine their nature. [7]

(P1 – Jan 2005)

(23). The curve C has equation

$$y = 5 + 9x^2 - 2x^3.$$

Find the coordinates of the stationary points of C and determine the nature of each of these points. [8]

(P1 – May 2004)

(24). A curve C has equation

$$y = 2x^3 - 24x + 5.$$

(a) Find the coordinates of the stationary points of C and determine the nature of these points. [7]

(b) Sketch C. [3]

(P1 – Nov 2003)

(25). The curve C has equation $y = 2x^3 - 6x^2 + 3$.

(a) Find the coordinates of the stationary points of C and determine their nature. [7]

(b) Sketch C. [2]

(c) The straight line $y = k$ intersects C in three distinct points. State the range of the possible values of k. [2]

(P1 – May 2003)

(26). Find the coordinates of the stationary points of the curve

$$y = 5x^6 - 12x^5$$

and determine the nature of these points. [8]

(P1 – Jan 2003)