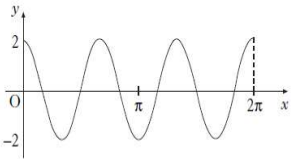
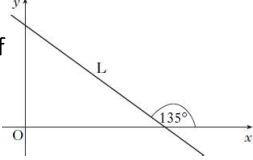
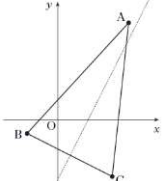
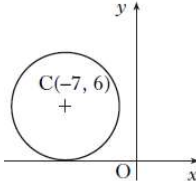
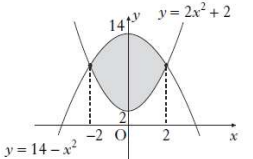


Homework Sheet 1

1	Show that $(x - 1)$ is a factor of $f(x) = 2x^3 + x^2 - 8x + 5$. Hence fully factorise $f(x)$ fully.	
2	Express $x^2 + 8x + 3$ in the form $(x + p)^2 + q$ and state the coordinates of the turning point of the parabola.	
3	Evaluate: $\log_5 2 + \log_5 50 - \log_5 4$	
4	What is the solution of the equation $2\sin x - \sqrt{3} = 0$ where $\frac{\pi}{2} \leq x \leq \pi$?	
5	Given that $0 \leq a \leq \frac{\pi}{2}$ and $\sin a = \frac{3}{5}$, find an expression for $\sin(x + a)$.	
6	If $y = 4x^3 + 5x^2 - 3x + 2$, find $\frac{dy}{dx}$.	
7	Find the coordinates of the turning points of the curve with equation $y = x^3 - 3x^2 - 9x + 12$ and determine their nature.	
8	Find $\int (2x^{-4} + \cos 5x) dx$.	
9	$\frac{dy}{dx} = 8x - 3$. If $y = 7$ when $x = 2$, find an equation for y .	
10	The expression $\sqrt{3}\sin x^\circ - \cos x^\circ$ can be written in the form $k\sin(x - a)^\circ$, where $k > 0$ and $0 \leq a < 360$. Calculate the values of k and a .	

Homework Sheet 1

Mark:

<p>11 A function f is given by $f(x) = \sqrt{9 - x^2}$. What is a suitable domain of f?</p>	
<p>12 The diagram shows the graph with equation of the form $y = a\cos bx$ for $0 \leq x \leq 2\pi$. What is the equation of this graph?</p> 	
<p>13 $E(-2, -1, 4)$, $P(1, 5, 7)$ and $F(7, 17, 13)$ are three collinear points. P lies between E and F. What is the ratio in which P divides EF?</p>	
<p>14 Vectors \mathbf{p} and \mathbf{q} are such that $\mathbf{p} = 3$, $\mathbf{q} = 4$ and $\mathbf{p} \cdot \mathbf{q} = 10$. Find the value of $\mathbf{q} \cdot (\mathbf{p} + \mathbf{q})$.</p>	
<p>15 Write down the exact values of $\sin 60^\circ$ and $\tan \frac{\pi}{6}$.</p>	
<p>16 The diagram shows a line L; the angle between L and the positive direction of the x-axis is 135°, as shown. What is the gradient of the line L?</p> 	
<p>17 The vertices of triangle ABC are $A(7, 9)$, $B(-3, -1)$ and $C(5, -5)$ as shown in the diagram. Find the equation of the median from C.</p> 	
<p>18 The x-axis is a tangent to a circle with centre $(-7, 6)$ as shown in the diagram. What is the equation of the circle?</p> 	
<p>19 A sequence is defined by the recurrence relation $u_{n+1} = 0.3u_n + 6$ with $u_{10} = 10$ What is the value of u_{12}?</p>	
<p>20 The diagram shows graphs with equations $y = 14 - x^2$ and $y = 2x^2 + 2$. Calculate the shaded area.</p> 	

Homework Sheet 2

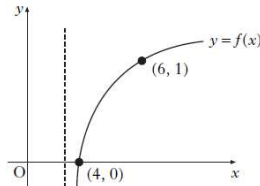
1 Show that $(x - 1)$ is a factor of $x^3 - 3x + 2$. Hence or otherwise factorise $x^3 - 3x + 2$ fully.	
2 $2x^2 + 4x + 7$ is expressed in the form $2(x + p)^2 + q$. What is the value of q .	
3 If $\log_4 12 - \log_4 x = \log_4 6$, what is the value of x ?	
4 Solve $2\cos x = \sqrt{3}$ for x , where $0 \leq x < 2\pi$.	
5 If the exact value of $\cos x$ is $\frac{1}{\sqrt{5}}$, find the exact value of $\cos 2x$.	
6 Given that $f(x) = (4 - 3x^2)^{-\frac{1}{2}}$ on a suitable domain, find $f'(x)$.	
7 Find the coordinates of the stationary points on the curve $f(x) = x^3 - 3x + 2$ and determine their nature.	
8 Find $\int (4x^{\frac{1}{2}} + x^{-3}) dx$, where $x > 0$.	
9 The graph of $y = f(x)$ passes through the point $(\frac{\pi}{9}, 1)$. If $f'(x) = \sin(3x)$ express y in terms of x .	
10 Write $\sin x - \cos x$ in the form $k\sin(x - a)$ stating the values of k and a where $k > 0$ and $0 \leq a \leq 2\pi$.	

Homework Sheet 2

Mark:

11 Functions f and g are given by $f(x) = 3x + 1$ and $g(x) = x^2 - 2$.
Find $f(g(x))$ and $g(f(x))$.

12 The diagram shows the graph of $y = f(x)$ where f is a logarithmic function. What are the values of a and b for $f(x) = \log_a(x - b)$?



13 The vectors $u = \begin{pmatrix} k \\ -1 \\ 1 \end{pmatrix}$ and $v = \begin{pmatrix} 0 \\ 4 \\ k \end{pmatrix}$ are perpendicular. What is the value of k ?

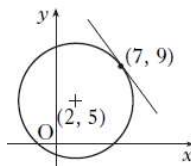
14 D, E and F have coordinates $(10, -8, -15)$, $(1, -2, -3)$ and $(-2, 0, 1)$ respectively. Show that D, E and F are collinear and find the ratio in which E divides DF.

15 Prove that $\frac{\cos^3 x}{1 - \sin^2 x} = \cos x$.

16 The line L passes through the point $(-2, -1)$ and is parallel to the line with equation $5x + 3y - 6 = 0$. What is the equation of L?

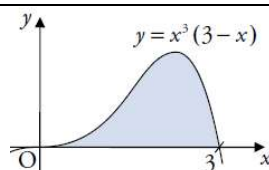
17 Triangle PQR has vertices at $P(-3, -2)$, $Q(-1, 4)$ and $R(3, 6)$. PS is a median. What is the gradient of PS?

18 The diagram shows a circle, centre $(2, 5)$ and a tangent drawn at the point $(7, 9)$. What is the equation of this tangent?



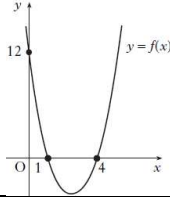
19 A sequence is generated by the recurrence relation $u_{n+1} = 0.4u_n - 240$. What is the limit of this sequence as $n \rightarrow \infty$?

20 Calculate the shaded area enclosed by the curve $y = x^3(3 - x)$ and the x -axis between $x = 0$ and $x = 3$.



Homework Sheet 3

1 The graph has an equation of the form $y = k(x - a)(x - b)$. What is the equation of the graph?

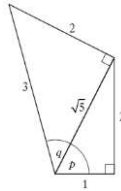


2 For what values of x is $6 + x - x^2 < 0$?

3 Express $\log_a 25 + \log_a 4 - \log_a 20$ as the logarithm of a single number.

4 Solve $\cos 2x - 3\cos x + 2 = 0$ for $0 \leq x < 360$.

5 The diagram shows two right-angled triangles with sides and angles given. What is the value of $\sin(p + q)$?



6 What is the derivative of $(x^3 + 4)^2$?

7 The point $P(5, 12)$ lies on the curve with equation $y = x^2 - 4x + 7$. Find the equation of the tangent to the curve.

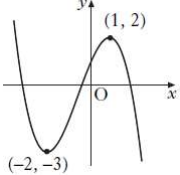
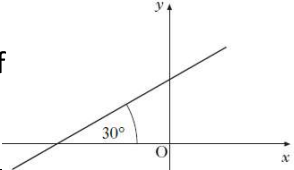
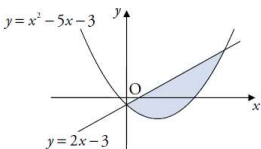
8 Find $\int 4 \sin(2x + 3) dx$.

9 Find $\int_{-2}^2 (x + 1)^2 dx$.

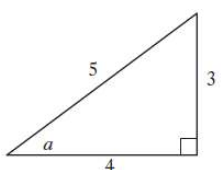
10 Write $2\sin x^\circ + 3\cos x^\circ$ in the form $k\sin(x - a)$, for $k > 0$ and $0 \leq a \leq 360$.

Homework Sheet 3

Mark:

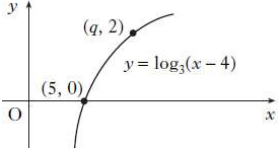
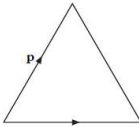
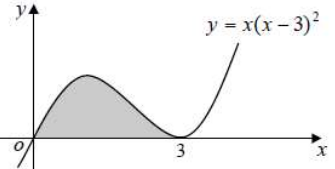
<p>11 Functions f and g are defined on a suitable domain by $f(x) = \cos x$ and $g(x) = x + \frac{\pi}{6}$. What is the value of $f\left(g\left(\frac{\pi}{6}\right)\right)$?</p>	
<p>12 The diagram shows the graph of $y = f(x)$. Sketch $y = f(x + 2) - 1$</p>	
<p>13 Given that $\mathbf{u} = \begin{pmatrix} 2 \\ 0 \\ 1 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} -1 \\ 2 \\ 4 \end{pmatrix}$, find $3\mathbf{u} - 2\mathbf{v}$ in component form.</p>	
<p>14 The vectors $x\mathbf{i} + 5\mathbf{j} + 7\mathbf{k}$ and $-3\mathbf{i} + 2\mathbf{j} - \mathbf{k}$ are perpendicular. What is the value of x?</p>	
<p>15 Prove that $2\cos^2 A + 3\sin^2 A - 2 = \sin^2 A$.</p>	
<p>16 A line makes an angle of 30° with the positive direction of the x-axis as shown. What is the gradient of the line?</p>	
<p>17 Find the equation of the perpendicular bisector of the line joining $P(3, -3)$ to $Q(-1, 9)$.</p>	
<p>18 Write down the centre and calculate the radius of the circle with equation $x^2 + y^2 + 8x + 4y - 38 = 0$</p>	
<p>19 A sequence is defined by the recurrence relation $u_{n+1} = 2u_n + 3$ and $u_0 = 1$. What is the value of u_3?</p>	
<p>20 Calculate the shaded area enclosed by the line $y = 2x - 3$ and the curve $y = x^2 - 5x - 3$.</p>	

Homework Sheet 4

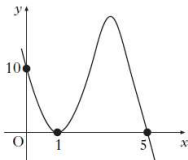
<p>1 Show that $x = 1$ is a root of $x^3 + 8x^2 + 11x - 20 = 0$. Hence factorise $x^3 + 8x^2 + 11x - 20$ fully.</p>	
<p>2 The roots of the equation $kx^2 - 3x + 2 = 0$ are equal. Calculate the value of k.</p>	
<p>3 Evaluate $\log_2 \frac{1}{16}$.</p>	
<p>4 Solve the equation $3\cos 2x + \cos x = -1$ in the interval $0 \leq x \leq 360$.</p>	
<p>5 The diagram shows a right-angled triangle with sides and angles marked. What is the value of $\cos 2a$?</p>	
<p>6 $A = 2\pi r^2 + 6\pi r$. What is the rate of change of A with respect to r when $r = 2$?</p>	
<p>7 Find the equation of the tangent to the curve $y = x^3 - 3x^2 + 2x$ at the point where $x = 1$.</p>	
<p>8 Find $\int \frac{1}{3x^4} dx$, where $x \neq 0$.</p>	
<p>9 Evaluate $\int_0^{\frac{\pi}{2}} \sin 2x + \cos 2x dx$.</p>	
<p>10 Write $3\cos x^\circ + 4\sin x^\circ$ in the form $k\cos(x + a)$ for $k > 0$ and $0 \leq x \leq 360$</p>	

Homework Sheet 4

Mark:

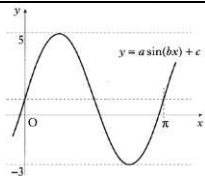
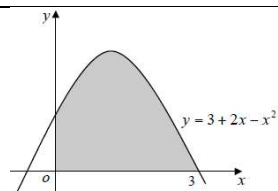
<p>11 Functions f and g are defined on the set of real numbers by $f(x) = x^2 + 3$ and $g(x) = x + 4$. Find expressions for $f(g(x))$ and $g(f(x))$.</p>	
<p>12 The diagram shows part of the graph of $y = \log_3(x - 4)$. The point $(q, 2)$ lies on the graph. What is the value of q?</p>	 <p>The diagram shows a Cartesian coordinate system with x and y axes. The origin is labeled O. A curve representing the function $y = \log_3(x - 4)$ is plotted. The curve passes through the point $(5, 0)$ and another point $(q, 2)$. The equation $y = \log_3(x - 4)$ is written next to the curve.</p>
<p>13 Given that the ratio $S(-4, 5, 1)$, $T(-16, -4, 16)$ and $U(-24, -10, 26)$ are collinear, calculate the ratio in which T divides SU.</p>	
<p>14 An equilateral triangle of side 3 units is shown. The vectors \mathbf{p} and \mathbf{q} are as represented in the diagram. What is the value of $\mathbf{p} \cdot \mathbf{q}$?</p>	 <p>The diagram shows an equilateral triangle. Vector \mathbf{p} is drawn from the top vertex to the bottom-left vertex. Vector \mathbf{q} is drawn from the bottom-left vertex to the bottom-right vertex.</p>
<p>15 Convert 135° into radians and convert $\frac{2\pi}{3}$ into degrees.</p>	
<p>16 Calculate the distance between the points $(4, -1)$ and $(7, 3)$.</p>	
<p>17 A triangle has vertices $P(1, 8)$, $Q(-12, -2)$ and $R(8, -6)$. Calculate the median PS.</p>	
<p>18 The line with equation $y = 2x$ intersects the circle with equation $x^2 + y^2 = 5$ at the points J and K. What are the x-coordinates of J and K?</p>	
<p>19 A sequence is generated by the recurrence relation $u_{n+1} = 0.7u_n + 10$. What is the limit of this sequence as $n \rightarrow \infty$?</p>	
<p>20 Calculate the shaded area shown in the diagram.</p>	 <p>The diagram shows a Cartesian coordinate system with x and y axes. The origin is labeled O. A curve representing the function $y = x(x - 3)^2$ is plotted. The curve starts at the origin, rises to a local maximum, crosses the x-axis at $x = 3$, reaches a local minimum, and then rises again. The area between the curve and the x-axis from $x = 0$ to $x = 3$ is shaded.</p>

Homework Sheet 5

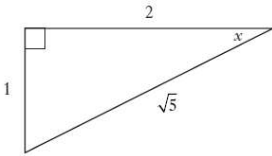
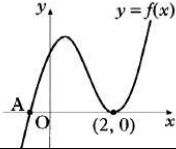
<p>1 The diagram shows the graph with equation $y = k(x - 1)^2(x + t)$. What are the values of k and t?</p> 	
<p>2 What is the solution of $x^2 + 4x > 0$, where x is a real number?</p>	
<p>3 Find x if $\log_x 6 - 2\log_x 4 = 1$.</p>	
<p>4 Solve the equation $\sin 2x - \cos x = 0$ in the interval $0 \leq x \leq 180$.</p>	
<p>5 If a and b are acute angles such that $\sin a = \frac{4}{5}$ and $\sin b = \frac{5}{13}$, find the value of $\sin(a + b)$.</p>	
<p>6 If $f(x) = \frac{1}{\sqrt[5]{x}}$, $x \neq 0$, what is $f'(x)$?</p>	
<p>7 Find the equation of the tangent to the curve with equation $y = x^3 + 2x^2 - 3x + 2$ at the point where $x = 1$.</p>	
<p>8 Find $\int (2x - 1)^{\frac{1}{2}} dx$ where $x > \frac{1}{2}$.</p>	
<p>9 Find $\int_0^1 \frac{dx}{(3x+1)^{\frac{1}{2}}}$</p>	
<p>10 Express $3\cos x^\circ + 5\sin x^\circ$ in the form $k\cos(x - a^\circ)$ where $k > 0$ and $0 \leq a \leq 90$.</p>	

Homework Sheet 5

Mark:

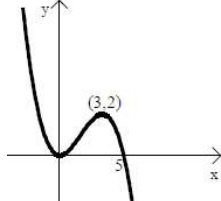
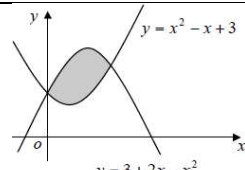
<p>11 The functions f and g are defined by $f(x) = x^2 + 1$ and $g(x) = 3x - 4$, on the set of real numbers. Find $f(g(x))$ and $g(f(x))$.</p>	
<p>12 The diagram shows a sketch of a trig function whose equation is of the form $y = a \sin(bx) + c$. Determine the values of a, b and c.</p> 	
<p>13 Show that the points $A(-7, -8, 1)$, $T(3, 2, 5)$ and $B(18, 17, 11)$ are collinear. Find the ratio in which T divides AB.</p>	
<p>14 P, Q and R have coordinates $(1, 3, -1)$, $(2, 0, 1)$ and $(-3, 1, 2)$ respectively. Express the vectors \overrightarrow{QP} and \overrightarrow{QR} in component form. Hence or otherwise find the size of angle PQR.</p>	
<p>15 What is the exact value of $\frac{7\pi}{4}$?</p>	
<p>16 Find the equation of the line which passes through the point $(-1, 3)$ and is perpendicular to the line with equation $4x + y - 1 = 0$.</p>	
<p>17 A triangle has vertices $A(-3, 1)$, $B(4, 3)$ and $C(6, -5)$. Find the equation of the altitude BP.</p>	
<p>18 A circle C_1 has equation $x^2 + y^2 + 2x + 4y - 27 = 0$. Write down the centre and calculate the radius of C_1.</p>	
<p>19 A sequence is generated by the recurrence relation $u_{n+1} = \frac{1}{4}u_n + 7$, with $u_0 = -2$. What is the limit of this sequence as $n \rightarrow \infty$?</p>	
<p>20 Calculate the shaded area shown in the diagram.</p> 	

Homework Sheet 6

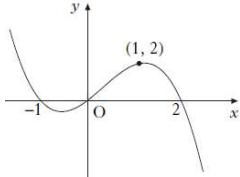
<p>1 A function f is defined on the set of real numbers by $f(x) = x^3 - x^2 + x + 3$. What is the remainder when $f(x)$ is divided by $(x - 1)$?</p>	
<p>2 If $x^2 - 8x + 7$ is written in the form $(x - p)^2 + q$, what is the value of q?</p>	
<p>3 Given that $\log_{10}x = 3\log_{10}y + \log_{10}2$, express x in terms of y.</p>	
<p>4 Solve the equation $2\cos 3x = 1$, for $0 \leq x \leq 360$</p>	
<p>5 The diagram shows a right-angled triangle with sides and angles marked. Find the value of $\sin 2x$.</p>	
<p>6 If $s(t) = t^2 - 5t + 8$, what is the rate of change of s with respect to t when $t = 3$?</p>	
<p>7 The diagram shows part of the graph of the curve $y = 2x^3 - 7x^2 + 4x + 4$. Find the x-coordinate of the maximum turning point.</p>	
<p>8 Find $\int x(3x + 2)dx$.</p>	
<p>9 Find $f(x)$ given that $f'(x) = 2 - \frac{1}{x^2}$ and $f(1) = 8$.</p>	
<p>10 Write $1.5\cos x^\circ + 2\sin x^\circ$ in the form $k\cos(x + a)^\circ$, where $0 \leq a \leq 180$.</p>	

Homework Sheet 6

Mark:

<p>11 A function f is defined on a suitable domain by $f(x) = \frac{x+2}{x^2-7x+12}$. What value(s) of x cannot be in this domain?</p>	
<p>12 The graph of $y = f(x)$ is shown. Sketch the graphs of $y = -f(x)$ and $y = -f(x) + 3$.</p>	
<p>13 The point Q divides the line joining $P(-1, -1, 0)$ to $R(5, 2, -3)$ in the ratio 2: 1. Find the coordinates of Q.</p>	
<p>14 If $u = \begin{pmatrix} -3 \\ 1 \\ 2t \end{pmatrix}$ and $v = \begin{pmatrix} 1 \\ t \\ -1 \end{pmatrix}$ are perpendicular, what is the value of t?</p>	
<p>15 Prove the identity: $2\cos^2 x - 1 = 1 - 2\sin^2 x$</p>	
<p>16 A line makes an angle of 45° with the positive direction of the x-axis. What is its gradient?</p>	
<p>17 Triangle ABC has vertices $A(-1, 6)$, $B(-3, -2)$ and $C(5, 2)$. Find the equation of the line q, the perpendicular bisector of BC.</p>	
<p>18 The point $P(2, 3)$ lies on the circle $(x + 1)^2 + (y - 1)^2 = 13$. Find the equation of the tangent at P.</p>	
<p>19 A sequence is defined by the recurrence relation $u_{n+1} = \frac{1}{3}u_n + 1$, with $u_2 = 15$. What is the value of u_4?</p>	
<p>20 Calculate the area enclosed between the curves $y = x^2 - x + 3$ and $y = 3 + 2x - x^2$.</p>	

Homework Sheet 7

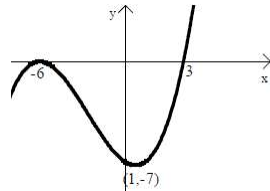
<p>1</p> <p>The diagram shows the graph of a cubic. What is the equation of this cubic?</p>	
<p>2</p> <p>If $f(x) = (x - 3)(x + 5)$, for what values of x is the graph of $y = f(x)$ above the x-axis?</p>	
<p>3</p> <p>Simplify $5\log_8 2 + \log_8 4 - \log_8 16$</p>	
<p>4</p> <p>Solve $4\sin^2 x = 3$ for $0 \leq x \leq 360$.</p>	
<p>5</p> <p>If $\cos A = \frac{5}{13}$ and $\sin B = \frac{4}{5}$, show that $\sin(A + B) = \frac{56}{65}$.</p>	
<p>6</p> <p>Given that $f(x) = 4\sin 3x$, find $f'(0)$.</p>	
<p>7</p> <p>A curve has equation $y = x - \frac{16}{\sqrt{x}}$, $x > 0$. Find the equation of the tangent at the point where $x = 4$.</p>	
<p>8</p> <p>Find $\int (1 - 6x)^{-\frac{1}{2}} dx$ where $x < \frac{1}{6}$.</p>	
<p>9</p> <p>$\frac{dy}{dx} = 6x^2 - 4x + 3$. If $y = 5$ when $x = 1$, find an equation for y.</p>	
<p>10</p> <p>Express $8\cos x^\circ - 6\sin x^\circ$ in the form $k\cos(x + a)^\circ$ where $k > 0$ and $0 < a < 360$.</p>	

Homework Sheet 7

Mark:

11
 $f(x) = 3 - x$ and $g(x) = \frac{3}{x}, x \neq 0$.
 Find $p(x) = f(g(x))$.
 If $q(x) = \frac{3}{3-x}, x \neq 3$, find $p(q(x))$ in its simplest form.

12 The diagram shows $y = f(x)$. Sketch the graphs of $y = -2f(x)$ and $y = f(x - 3)$.



13
 Show that the points P(3, 2, 6), Q(5, -2, 10) and R(9, -10, 18) are collinear.

14
 Given that $\mathbf{a} = \begin{pmatrix} 3 \\ 4 \\ 0 \end{pmatrix}$ and $\mathbf{a} \cdot (\mathbf{a} + \mathbf{b}) = 7$,
 what is the value of $\mathbf{a} \cdot \mathbf{b}$.

15
 Prove the identity:
 $\cos A \tan A = \sin A$.

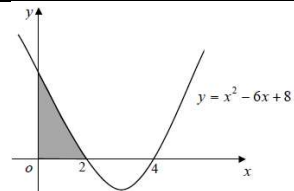
16
 Find the equation of the straight line through (1, -7) perpendicular to the line $y - 2x = 30$.

17
 Find the equation of the median from C for a triangle with vertices A(1, -7), B(-4, 7) and C(-1, 3).

18
 Find the equation of the tangent to the circle $x^2 + y^2 - 10y - 43 = 0$ at the point (2, -3).

19
 A sequence is generated by the recurrence relation $u_{n+1} = 0.4u_n - 30$.
 What is the limit of the sequence as $n \rightarrow \infty$?

20
 Calculate the shaded area shown in the diagram.

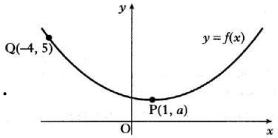
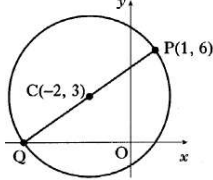
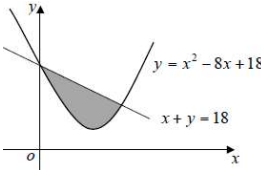


Homework Sheet 8

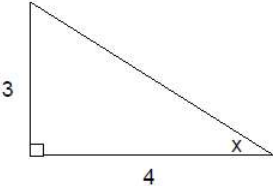
1 Show that $(x - 4)$ is a factor of $x^3 - 5x^2 + 2x + 8$. Hence, fully factorise and solve $x^3 - 5x^2 + 2x + 8$.	
2 Solve $6 - x - x^2 < 0$	
3 Before a forest fire was brought under control, the spread of the fire was described by a law of the form $A = A_0e^{kt}$ where A_0 is the area covered by the fire when it was first detected and A is the area covered by the fire t hours later. If it takes 1.5 hours for the area of the forest fire to double, find the value of the constant k .	
4 Solve $2 \sin(2x - 60)^\circ = 1$ for $0 \leq x \leq 360$.	
5 Using $75^\circ = 45^\circ + 30^\circ$, show that $\sin 75^\circ = \frac{\sqrt{6} + \sqrt{2}}{4}$.	
6 If $y = 3x^{-2} + 2x^{\frac{3}{2}}$, $x > 0$, determine $\frac{dy}{dx}$.	
7 The parabola with equation $y = x^2 - 14x + 53$ has a tangent at the point P(8, 5). Find the equation of this tangent.	
8 Find $\int \frac{(x^2-2)(x^2+2)}{x^2} dx$, $x \neq 0$	
9 The curve $y = f(x)$ is such that $\frac{dy}{dx} = 4x - 6x^2$. The curve passes through the point (-1, 9). Express y in terms of x .	
10 Express $3\cos x^\circ + 4\sin x^\circ$ in the form $k\cos(x - a)^\circ$ Hence, solve $3\cos x^\circ + 4\sin x^\circ = 5$	

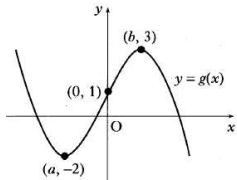
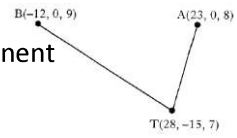
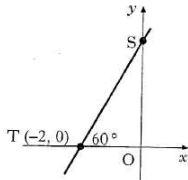
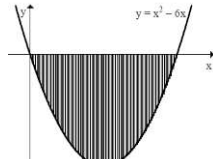
Homework Sheet 8

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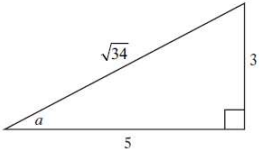
<p>11 $f(x) = 8x^2 - 5$ and $g(x) = 5 + x$</p> <p>Find $f(g(x))$ and $g(f(x))$.</p>	
<p>12 The diagram shows the graph of a function $y = f(x)$. Sketch the graphs of: $y = f(x - 4)$ and $y = 2 + f(x - 4)$.</p> 	
<p>13 $A(0, -3, 5)$, $B(7, -6, 9)$ and $C(21, -12, 17)$. Show that A, B and C are collinear, stating the ratio AB:BC.</p>	
<p>14 P is the point $(-1, 2, -1)$ and Q is $(3, 2, -4)$. Write down \overrightarrow{PQ} in component form. Calculate the length of \overrightarrow{PQ}. Find the components of a unit vector which is parallel to \overrightarrow{PQ}.</p>	
<p>15 Prove the identity:</p> $\cos^2 Q \tan^2 Q = 1 - \cos^2 Q$	
<p>16 The point A has coordinates $(7, 4)$. The straight lines with equations $x + 3y + 1 = 0$ and $2x + 5y = 0$ intersect at B. Find the gradient of AB.</p>	
<p>17 A triangle has vertices $A(5, 5)$, $B(-10, 0)$ and $C(0, -10)$. Find the equation of the altitude from A.</p>	
<p>18 A circle has centre $C(-2, 3)$ and passes through $P(1, 6)$. Find the equation of the circle.</p> 	
<p>19 A sequence is defined by the recurrence relation $u_{n+1} = 0.8u_n + 12$, $u_0 = 4$. State why this sequence has a limit and find this limit.</p>	
<p>20 Calculate the area between the line $y = x + 18$ and the curve $y = x^2 - 8x + 18$.</p> 	

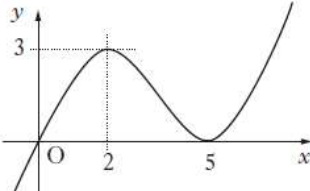
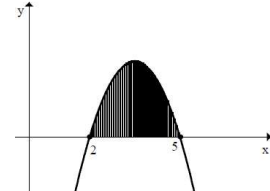
Homework Sheet 9

<p>1 Show that $(x + 2)$ is a factor of $f(x) = x^3 - 2x^2 - 4x + 8$ and hence fully factorise $f(x)$.</p>	
<p>2 Calculate the discriminant of the quadratic equation $2x^2 + 4x + 5 = 0$</p>	
<p>3 Solve the equation $\log_4(5 - x) - \log_4(3 - x) = 2$, $x < 3$.</p>	
<p>4 Find all the values of x in the interval $0 \leq x \leq 2\pi$ for which $\tan^2(x) = 3$.</p>	
<p>5 Show that the exact value of $\cos 2x$ is $\frac{7}{25}$.</p>	
<p>6 If $y = 3\cos^4 x$, find $\frac{dy}{dx}$.</p>	
<p>7 A curve has equation $y = x^3 - 3x^2 - 9x + 12$. Find the coordinates of the stationary points of this curve and determine their nature.</p>	
<p>8 Find $\int \frac{4x^3 - 1}{x^2} dx, x \neq 0$.</p>	
<p>9 Find the value of $\int_0^2 \sin(4x + 1) dx$.</p>	
<p>10 A curve has equation $y = 7\sin x - 24\cos x$. Express $7\sin x - 24\cos x$ in the form $k\sin(x - a)$ where $k > 0$ and $0 \leq a \leq \frac{\pi}{2}$.</p>	

<p>11</p> <p>$f(x) = 3x - 1$ and $g(x) = \frac{1}{x+1}$</p> <p>Find $f(g(x))$ and $g(f(x))$.</p> <p>State a suitable domain for $g(f(x))$.</p>	
<p>12</p> <p>The diagram shows the graph $y = g(x)$.</p> <p>a. Sketch $y = -g(x)$</p> <p>b. Sketch $y = 3 - g(x)$</p>	
<p>13</p> <p>If $\mathbf{f} = 3\mathbf{i} + 2\mathbf{k}$ and $\mathbf{g} = 2\mathbf{i} + 4\mathbf{j} + 3\mathbf{k}$,</p> <p>Find $\mathbf{f} + \mathbf{g}$.</p>	
<p>14</p> <p>Express the vectors \overrightarrow{TA} and \overrightarrow{TB} in component form.</p> <p>Calculate the angle between \overrightarrow{TA} and \overrightarrow{TB}.</p>	
<p>15</p> <p>Prove the identity:</p> $(\cos P^\circ + \sin P^\circ)^2 = 2\sin P^\circ \cos P^\circ + 1$	
<p>16</p> <p>Find the equation of the line ST, where T is the point $(-2, 0)$ and angle STO is 60°.</p>	
<p>17</p> <p>Triangle ABC has vertices $A(-1, 12)$, $B(-2, -5)$ and $C(7, -2)$. Find the equation of the altitude AE.</p>	
<p>18</p> <p>Show that the line with equation $y = 6 - 2x$ is a tangent to the circle with equation $x^2 + y^2 + 6x - 4y - 7 = 0$ and find the coordinates of the point of contact of the tangent and the circle.</p>	
<p>19</p> <p>A sequence is defined by the recurrence relation $u_{n+1} = 0.2u_n + 5$ with $u_8 = 20$.</p> <p>Calculate u_{10}.</p>	
<p>20</p> <p>Calculate the area enclosed between the curve $y = x^2 - 6x$ and the x-axis.</p>	

Homework Sheet 10

<p>1 Show that $(3x + 1)$ is a factor of $g(x) = 3x^3 + 4x^2 - 5x - 2$. Hence fully factorise $g(x)$.</p>	
<p>2 Solve $1 - 2x - 3x^2 > 0$, where x is a real number.</p>	
<p>3 Solve the equation $\log_2(x + 1) - 2\log_2 3 = 3$.</p>	
<p>4 Solve $2\tan 3x + 2 = 0$ for $0 \leq x \leq 360$.</p>	
<p>5 A right-angled triangle has sides and angles as shown in the diagram. What is the value of $\sin 2a$?</p>	
<p>6 Given that $y = \sin(x^2 - 3)$, find $\frac{dy}{dx}$.</p>	
<p>7 A curve has equation $y = 3x^2 - x^3$. Find the coordinates of the stationary points on this curve and determine their nature.</p>	
<p>8 Find $\int (2x + 9)^5 dx$</p>	
<p>9 Find $\int_0^2 \sqrt{4x + 1} dx$.</p>	
<p>10 Express $f(x) = \sqrt{3}\cos x + \sin x$ in the form $k\sin(x + a)$, where $k > 0$ and $0 < a < \frac{\pi}{2}$.</p>	

<p>11 A function f, defined on a suitable domain, is given by $f(x) = \frac{6x}{x^2+6x-16}$. What restrictions are there on the domain of f?</p>	
<p>12 The diagram shows part of the graph of $y = f(x)$. Sketch the graph of $y = 2f(x) + 1$</p> 	
<p>13 $\mathbf{p} = -\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}$ and $\mathbf{q} = 7\mathbf{i} - \mathbf{j} + 5\mathbf{k}$ a) Express \overrightarrow{PQ} in component form. b) Find the length of PQ.</p>	
<p>14 The vectors $\mathbf{u} = \begin{pmatrix} 1 \\ k \\ k \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} -6 \\ 2 \\ 5 \end{pmatrix}$ are perpendicular. What is the value of k?</p>	
<p>15 Show that: $(1 + 2\sin x)(1 - 2\sin x) = 4\cos^2 x - 3$</p>	
<p>16 Find the equation of the line through the point $(-1, 4)$ which is parallel to the line with equation $3x - y + 2 = 0$.</p>	
<p>17 A triangle has vertices $P(-2, 2)$, $Q(6, 6)$ and $R(6, -4)$ Find the equation of the perpendicular bisector of PR.</p>	
<p>18 Find P and Q, the points of intersection of the line $y = 3x - 5$ and the circle C_1 with equation $x^2 + y^2 + 2x - 4y - 15 = 0$.</p>	
<p>19 A sequence is defined by the recurrence relation $u_{n+1} = \frac{1}{4}u_n + 16$, $u_0 = 0$. Calculate the values of u_1, u_2, and u_3.</p>	
<p>20 Calculate the shaded area between the curve $y = -x^2 + 7x - 10$ and the x-axis.</p> 	

HOMEWORK 1	HOMEWORK 2
<ol style="list-style-type: none"> 1. $f(x) = (x - 1)(2x + 5)(x - 1)$ 2. $(x + 4)^2 - 13$ Min T.P at $(-4, -13)$ 3. 2 4. $x = \frac{2\pi}{3}$ for $\frac{\pi}{2} \leq x \leq \pi$ 5. $\sin(x + a) = \frac{4}{5}\sin x + \frac{3}{5}\cos x$ 6. $\frac{dy}{dx} = 12x^2 + 10x - 3$ 7. Max T.P at $(-1, 17)$ and Min T.P. at $(3, -15)$ 8. $\frac{-2x^{-3}}{3} + \frac{1}{5}\sin 5x + C$ 9. $y = 4x^2 - 3x - 3$ 10. $k = 2$ and $a = 30^\circ$ 11. $x \leq 3$ 12. $a = 2$ $b = 3$ 13. 1:2 14. 26 15. $\sin 60 = \frac{\sqrt{3}}{2}$ $\tan \frac{\pi}{6} = \frac{1}{\sqrt{3}}$ 16. $m = -1$ 17. $y = -3x + 10$ 18. $(x - 6)^2 + (y + 7)^2 = 36$ 19. $u_{12} = 8.7$ 20. Area = 32 square units 	<ol style="list-style-type: none"> 1. $f(x) = (x - 1)(x + 2)(x - 1)$ 2. $q = 5$ 3. $x = 2$ 4. $x = \frac{\pi}{6}, \frac{11\pi}{6}$ 5. $\cos 2x = \frac{-3}{5}$ 6. $f'(x) = 3x(4 - 3x^2)^{-\frac{3}{2}}$ 7. Max T.P. at $(-1, 4)$ and Min T.P. at $(1, 0)$ 8. $\frac{8}{3}x^{\frac{3}{2}} - \frac{1}{2}x^{-2} + C$ 9. $y = \frac{-1}{3}\cos 3x + \frac{7}{6}$ 10. $\sqrt{2}\sin\left(x - \frac{\pi}{4}\right)$ 11. $f(g(x)) = 3x^2 - 5$ $g(f(x)) = 9x^2 + 6x - 1$ 12. $a = 3$ $b = 3$ 13. $k = 4$ 14. $\overrightarrow{DE} = 3\overrightarrow{EF}$ so \overrightarrow{DE} and \overrightarrow{EF} are parallel. E is a common point so D,E,F are collinear. 15. Proof. 16. $3y + 5x = -13$ 17. $m_{PS} = \frac{7}{4}$ 18. $4y + 5x = 71$ 19. $L = -400$ 20. Area = $12\frac{3}{20}$ square units.
HOMEWORK 3	HOMEWORK 4
<ol style="list-style-type: none"> 1. $Y = 3(x - 1)(x - 4)$ 2. $x > -2$ $x < 3$ 3. $\log_a 5$ 4. $x = 0^\circ, 60^\circ, 300^\circ, 360^\circ$ 5. $\sin(p + q) = \frac{2+2\sqrt{3}}{3\sqrt{5}}$ 6. $\frac{dy}{dx} = 6x^5 + 24x^2$ 7. $y = 6x - 18$ 8. $-2\cos(2x + 3) + C$ 9. $9\frac{1}{3}$ 10. $\sqrt{13}\sin(x - 56.3)$ 11. $f\left(g\left(\frac{\pi}{6}\right)\right) = 9\frac{1}{3}$ 12. Correct shape, Min T.P at $(-4, -3)$ Max T.P. at $(-1, 1)$ 13. $\begin{pmatrix} 8 \\ -4 \\ -5 \end{pmatrix}$ 14. $x = 1$ 15. Proof 16. $m = \frac{1}{\sqrt{3}}$ 17. $3y - x - 8 = 0$ 18. Centre $(-4, -2)$ radius = $\sqrt{58}$ 19. $u_3 = 29$ 	<ol style="list-style-type: none"> 1. $(x - 1)(x + 4)(x + 5)$ 2. $k = \frac{9}{8}$ 3. -4 4. $x = 60^\circ, 132^\circ, 228^\circ, 300^\circ$ 5. $\cos 2a = \frac{17}{25}$ 6. 14π 7. $y = -x + 1$ 8. $\frac{x^{-3}}{-9} + C$ 9. 1 10. $5\cos(x + 127^\circ)$ 11. $f(g(x)) = x^2 + 8x + 19$ $g(f(x)) = x^2 + 7$ 12. $q = 13$ 13. 3:2 14. $\frac{9}{2}$ 15. $120^\circ = \frac{3\pi}{4}$ and $\frac{2\pi}{3} = 120^\circ$ 16. 5 units 17. $y = 4x + 4$ 18. $J(-1, -2)$ $K(1, 2)$ 19. $l = 13.\dot{3}$ 20. Area = $\frac{27}{4}$ square units

20. Area = $57\frac{1}{6}$ square units	
<p style="text-align: center;">HOMEWORK 5</p> <ol style="list-style-type: none"> $K = -2$ and $t = -5$ $x > 0$ $x < -4$ $x = \frac{3}{8}$ $x = 30^\circ, 90^\circ, 150^\circ$ $\sin(a + b) = \frac{63}{65}$ $f'(x) = -\frac{1}{5}x^{-\frac{6}{5}}$ $y = 4x - 2$ $\frac{(2x-1)^2}{3} + C$ $\frac{4}{3}$ $\sqrt{34}\cos(x - 333)^\circ$ $f(g(x)) = 9x^2 - 24x + 17$ $g(f(x)) = 3x^2 - 1$ $a = 4$ $b = 2$ $c = 1$ 3:2 $\theta = 60.8^\circ$ $\tan\frac{7\pi}{4} = -\frac{1}{\sqrt{2}}$ $y = \frac{1}{4}x + \frac{13}{4}$ $y = \frac{3}{2}x - 3$ Centre $(-1, -2)$ Radius $\sqrt{32}$ $L = \frac{28}{3}$ Area = 9 square units 	<p style="text-align: center;">HOMEWORK 6</p> <ol style="list-style-type: none"> 4 $q = -9$ $x = 2y^3$ $x = 20^\circ, 100^\circ, 140^\circ, 220^\circ, 260^\circ, 340^\circ$ $\sin 2x = \frac{4}{5}$ 1 Max T.P. when $x = \frac{1}{3}$ $x^3 + x^2 + c$ $f(x) = 2x + \frac{1}{x} + 5$ $2.5\cos(x + 127)^\circ$ $x \neq 3$ and $x \neq 4$ Correct shape drawn and labelled with $(0,3), (3,1), (5,3)$ $Q(3, 1, -2)$ $t = 1$ Proof. $m = 1$ $y = -2x + 2$ $y = -\frac{3}{2}x + 6$ $u_4 = 3$ Area = $\frac{11}{24}$ square units
<p style="text-align: center;">HOMEWORK 7</p> <ol style="list-style-type: none"> $y = -x(x + 1)(x - 2)$ $x < -5$ and $x > 3$ 1 $x = 60^\circ, 120^\circ, 240^\circ, 300^\circ$ Proof. 12 $y = 2x - 12$ $-\frac{(1-6x)^{\frac{1}{2}}}{3} + C$ $y = 2x^3 - 2x^2 + 3x + 2$ $10\cos(x + 36.9)^\circ$ $p(x) = 3 - \frac{3}{x}$ and $p(q(x)) = x$ $y = -2f(x)$ passing through $(-6, 0), (1, 14), (3, 0)$ and $y = f(x - 3)$ passing through $(-3, 0), (4, -7), (6, 0)$ $\overrightarrow{QR} = 2\overrightarrow{PQ}$ and Q is a common point so P, Q, R are collinear. $\mathbf{a} \cdot \mathbf{b} = -18$ Proof. $y = -\frac{1}{2}x + \frac{15}{2}$ $y = -6x - 3$ $y = \frac{1}{4}x - \frac{7}{2}$ $L = -50$ Area = $\frac{20}{3}$ square units 	<p style="text-align: center;">HOMEWORK 8</p> <ol style="list-style-type: none"> $(x - 4)(x - 2)(x + 1)$ $x < -3$ and $x > 2$ $k = 0.46$ $x = 45^\circ, 105^\circ, 225^\circ, 285^\circ$ Proof. $\frac{dy}{dx} = -6x^{-3} + 3x^{\frac{1}{2}}$ $y = 2x - 11$ $\frac{x^3}{3} + 4x^{-1} + C$ $y = 2x^2 - 2x^3 + 5$ $x = 53.1^\circ, 413.1^\circ$ $f(g(x)) = 8x^2 + 80x + 195$ $g(f(x)) = 8x^2$ $y = f(x - 4)$ passing through $(0,5), (5, a)$ $y = 2 + f(x - 4)$ passing through $(0,7), (5, a + 2)$ AB:BC = 1:2 Unit vector = $\begin{pmatrix} \frac{4}{5} \\ 0 \\ -\frac{3}{5} \end{pmatrix}$ Proof. $m=3$ $y = x$ $(x + 2)^2 + (y - 3)^2 = 18$ $L = 60$ Area = $\frac{343}{6}$ square units

HOMEWORK 9	HOMEWORK 10
<ol style="list-style-type: none"> 1. $(x + 2)(x - 2)(x - 2)$ 2. $b^2 - 4ac = -24$ 3. $x = \frac{43}{15}$ 4. $x = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$ 5. <i>Proof.</i> 6. $\frac{dy}{dx} = -12\sin x \cos^3 x$ 7. <i>Max T.P</i> at (-1, 17). <i>Min T.P</i> at (3, -15). 8. $2x^2 + \frac{1}{x} + C$ 9. 0.363 radians 10. $25\sin(x - 1.287)$ (in radians) 11. $f(g(x)) = \frac{-x+2}{x+1}$ $g(f(x)) = \frac{1}{3x}$ 12. $y = -g(x)$ passes through $(a, -2), (0, -1), (b, -3)$ $y = 3 - g(x)$ passes through $(a, 5), (0, 2), (b, 0)$ 13. $f + g = \sqrt{66}$ 14. $\theta = 50.9$ 15. <i>Proof.</i> 16. $y = \sqrt{3}x + 2\sqrt{3}$ 17. $y = -3x + 9$ 18. Point of contact is (1, 4) 19. $u_9 = 9$ $u_{10} = 6.8$ 20. Area = 36 square units 	<ol style="list-style-type: none"> 1. $3(3x + 1)(x + 2)(x - 1)$ 2. $-1 < x < \frac{1}{3}$ 3. $x = 71$ 4. $x = 45^\circ, 105^\circ, 165^\circ, 225^\circ, 285^\circ, 345^\circ$ 5. $\sin 2a = \frac{15}{17}$ 6. $\frac{dy}{dx} = 2x \cos(x^2 - 3)$ 7. <i>Min T.P</i> at (0, 0) <i>Max T.P</i> at (2, 4) 8. $\frac{(2x+9)^6}{12} + C$ 9. $\frac{13}{3}$ 10. $2\sin(x + \frac{\pi}{3})$ 11. $x \neq -8$, $x \neq 2$ 12. $y = 2f(x) + 1$ passes through (0, 1), (2, 7), (5, 1) 13. $\vec{PQ} = \begin{pmatrix} 8 \\ -4 \\ 1 \end{pmatrix}$ $\vec{PQ} = 9$ 14. $k = \frac{6}{7}$ 15. <i>Proof.</i> 16. $y = 3x + 7$ 17. $3y = 4x - 11$ 18. $P(1, -2)$ $Q(3, 4)$ 19. $u_1 = 16$ $u_2 = 20$ $u_3 = 21$ 20. Area = $\frac{9}{2}$ square units