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200 Higher Maths
Exam Type Questions

FORMULAE LIST

Circle:

The equation $x^2 + y^2 + 2gx + 2fy + c = 0$ represents a circle centre $(-g, -f)$ and radius $\sqrt{g^2 + f^2 - c}$.

The equation $(x-a)^2 + (y-b)^2 = r^2$ represents a circle centre (a, b) and radius r.

Scalar Product: $\mathbf{a}.\mathbf{b} = |\mathbf{a}||\mathbf{b}|\cos\theta$, where θ is the angle between $\mathbf{a}$ and $\mathbf{b}$

or $\mathbf{a}.\mathbf{b} = a_1b_1 + a_2b_2 + a_3b_3$ where $\mathbf{a} = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix}$.

Trigonometric formulae:

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A$$

$$= 2\cos^2 A - 1$$

$$= 1 - 2\sin^2 A$$

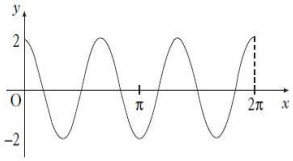
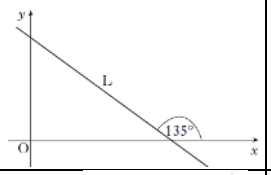
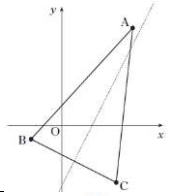
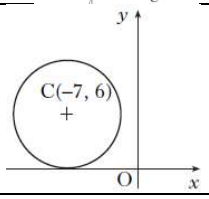
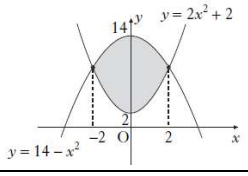
Table of standard derivatives:

$f(x)$	$f'(x)$
$\sin ax$	$a\cos ax$
$\cos ax$	$-a\sin ax$

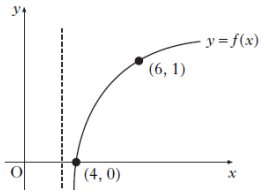
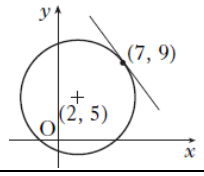
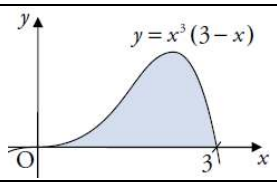
Table of standard integrals:

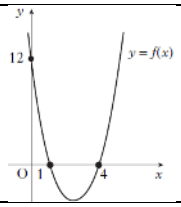
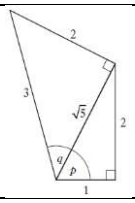
$f(x)$	$\int f(x)dx$
$\sin ax$	$-\frac{1}{a}\cos ax + c$
$\cos ax$	$\frac{1}{a}\sin ax + c$

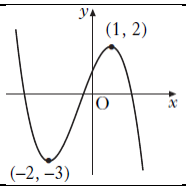
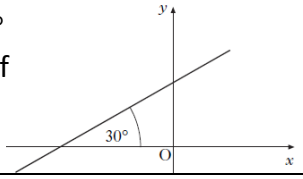
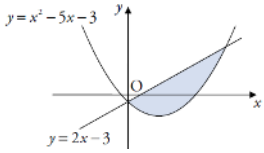
1	Show that $(x-1)$ is a factor of $f(x)=2x^3+x^2-8x+5$. Hence fully factorise $f(x)$ fully.	
2	Express x^2+8x+3 in the form $(x+p)^2+q$ and state the coordinates of the turning point of the parabola.	
3	Evaluate: $log_5 2 + log_5 50 - log_5 4$	
4	What is the solution of the equation $2sinx-\sqrt{3}=0$ where $\frac{\pi}{2}\leq x\leq \pi$?	
5	Given that $0\leq a\leq \frac{\pi}{2}$ and $sina=\frac{3}{5}$, find an expression for $\sin(x+a)$.	
6	If $=4x^3+5x^2-3x+2$, 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 $\int(2x^{-4}+cos5x)\,dx$.	
9	$\frac{dy}{dx}=8x-3$. If $y=7$ when $x=2$, find an equation for y.	
10	The expression $\sqrt{3}sinx°-cosx°$ can be written in the form $ksin(x-a)°$, where $k>0$ and $0\leq a<360$. Calculate the values of k and a.	

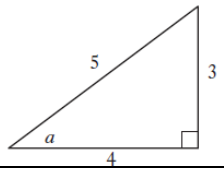
11 A function f is given by $f(x) = \sqrt{9 - x^2}$. What is a suitable domain of f?	
12 The diagram shows the graph with equation of the form $y = acosbx$ for $0 \leq x \leq 2\pi$. What is the equation of this graph? 	
13 $E(-2,-1,4), P(1,5,7) and\ F(7,17,13)$ are three collinear points. P lies between E and F. What is the ratio in which P divides EF?	
14 Vectors $\boldsymbol{p}$ and $\boldsymbol{q}$ are such that $\lvert\boldsymbol{p}\rvert = 3$, $\lvert\boldsymbol{q}\rvert = 4$ and $\boldsymbol{p}.\boldsymbol{q} = 10$. Find the value of $\boldsymbol{q}.(\boldsymbol{p} + \boldsymbol{q})$.	
15 Write down the exact values of $sin60°$ and $tan\frac{\pi}{6}$.	
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? 	
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. 	
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? 	
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}?	
20 The diagram shows graphs with equations $y = 14 - x^2$ and $y = 2x^2 + 2$. Calculate the shaded area. 	

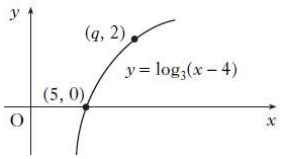
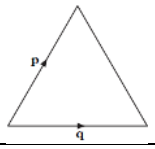
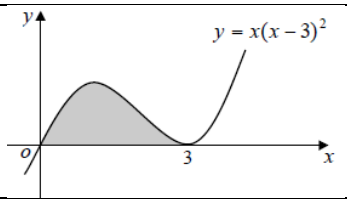
21 Show that $(x-1)$ is a factor of x^3-3x+2. Hence or otherwise factorise x^3-3x+2 fully.	
22 $2x^2+4x+7$ is expressed in the form $2(x+p)^2+q$. What is the value of q.	
23 If $log_4 12 - log_4 x = log_4 6$, what is the value of x?	
24 Solve $2cosx=\sqrt{3}$ for x, where $0 \leq x < 2\pi$.	
25 If the exact value of $cosx$ is $\frac{1}{\sqrt{5}}$, find the exact value of $cos2x$.	
26 Given that $f(x)=(4-3x^2)^{\frac{-1}{2}}$ on a suitable domain, find $f'(x)$.	
27 Find the coordinates of the stationary points on the curve $f(x)=x^3-3x+2$ and determine their nature.	
28 Find $\int \left(4x^{\frac{1}{2}}+x^{-3}\right)dx$, where $x>0$.	
29 The graph of $y=f(x)$ passes through the point $\left(\frac{\pi}{9},1\right)$. If $f'(x)=\sin(3x)$ express *y* in terms of x.	
30 Write $sinx-cosx$ in the form $ksin(x-a)$ stating the values of *k* and *a* where $k>0$ and $0 \leq a \leq 2\pi$.	

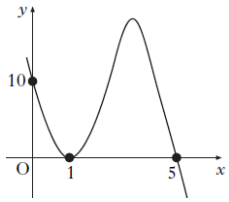
31	Functions f and g are given by $f(x) = 3x + 1$ and $g(x) = x^2 - 2$. Find $f\big(g(x)\big)$ *and* $g(f(x))$.	
32	The diagram shows the graph of $y = f(x)$ where f is a logarithmic function. What are the values of a and b for $(x) = log_a(x - b)$? 	
33	The vectors $\boldsymbol{u} = \begin{pmatrix} k \\ -1 \\ 1 \end{pmatrix}$ and $\boldsymbol{v} = \begin{pmatrix} 0 \\ 4 \\ k \end{pmatrix}$ are perpendicular. What is the value of k?	
34	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.	
35	Prove that $\frac{cos^3 x}{1 - sin^2 x} = cosx.$	
36	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?	
37	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?	
38	The diagram shows a circle, centre $(2, 5)$ and a tangent drawn at the point $(7, 9)$. What is the equation of this tangent? 	
39	A sequence is generated by the recurrence relation $u_{n+1} = 0.4u_n - 240$. What is the limit of this sequence as $\rightarrow \infty$?	
40	Calculate the shaded area enclosed by the curve $y = x^3(3 - x)$ and the x-axis between $x = 0$ and $x = 3$. 	

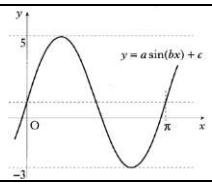
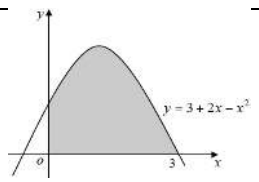
41 The graph has an equation of the form $y = k(x - a)(x - b)$. What is the equation of the graph? 	
42 For what values of x is $6 + x - x^2 < 0$?	
43 Express $log_a 25 + log_a 4 - log_a 20$ as the logarithm of a single number.	
44 Solve $cos2x - 3cosx + 2 = 0$ for $0 \leq x < 360$.	
45 The diagram shows two right-angled triangles with sides and angles given. What is the value of $\sin(p + q)$? 	
46 What is the derivative of $(x^3 + 4)^2$?	
47 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.	
48 Find $\int 4\sin(2x + 3)\, dx$.	
49 Find $\int_{-2}^{2} (x + 1)^2\, dx$.	
50 Write $2sinx° + 3cosx°$ in the form $ksin(x - a)$, for $k > 0$ and $0 \leq a \leq 360$.	

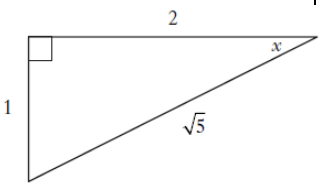
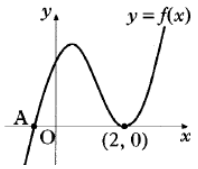
51 Functions f and g are defined on a suitable domain by $f(x) = cosx$ and $g(x) = x + \frac{\pi}{6}$. What is the value of $f\left(g\left(\frac{\pi}{6}\right)\right)$?	
52 The diagram shows the graph of $y = f(x)$. Sketch $y = f(x+2) - 1$ 	
53 Given that $\boldsymbol{u} = \begin{pmatrix} 2 \\ 0 \\ 1 \end{pmatrix}$ and $\boldsymbol{v} = \begin{pmatrix} -1 \\ 2 \\ 4 \end{pmatrix}$, find $3\boldsymbol{u} - 2\boldsymbol{v}$ in component form.	
54 The vectors $x\boldsymbol{i} + 5\boldsymbol{j} + 7\boldsymbol{k}$ and $-3\boldsymbol{i} + 2\boldsymbol{j} - \boldsymbol{k}$ are perpendicular. What is the value of x?	
55 Prove that $2cos^2A + 3sin^2A - 2 = sin^2A$.	
56 A line makes an angle of $30°$ with the positive direction of the x-axis as shown. What is the gradient of the line? 	
57 Find the equation of the perpendicular bisector of the line joining $P(3, -3)$ to $Q(-1, 9)$.	
58 Write down the centre and calculate the radius of the circle with equation $x^2 + y^2 + 8x + 4y - 38 = 0$	
59 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?	
60 Calculate the shaded area enclosed by the line $y = 2x - 3$ and the curve $y = x^2 - 5x - 3$. 	

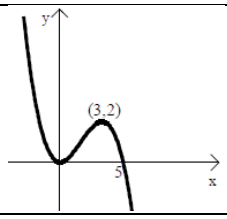
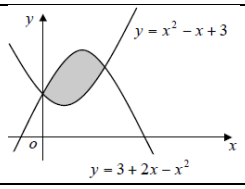
61 Show that $x = 1$ is a root of $x^3 + 8x^2 + 11x - 20 = 0$. Hence factorise $x^3 + 8x^2 + 11x - 20$ fully.	
62 The roots of the equation $kx^2 - 3x + 2 = 0$ are equal. Calculate the value of *k*.	
63 Evaluate $log_2 \frac{1}{16}$.	
64 Solve the equation $3cos2x + cosx = -1$ in the interval $0 \leq x \leq 360$.	
65 The diagram shows a right-angled triangle with sides and angles marked. What is the value of $cos2a$? 	
66 $A = 2\pi r^2 + 6\pi r$. What is the rate of change of *A* with repect to *r* when $r = 2$?	
67 Find the equation of the tangent to the curve $y = x^3 - 3x^2 + 2x$ at the point where x =1.	
68 Find $\int \frac{1}{3x^4}\, dx$, where $x \neq 0$.	
69 Evaluate $\int_0^{\frac{\pi}{2}} sin2x + cos2x \ dx$.	
70 Write $3cosx° + 4sinx°$ in the form $kcos(x + a)$ for $k > 0$ and $0 \leq x \leq 360$	

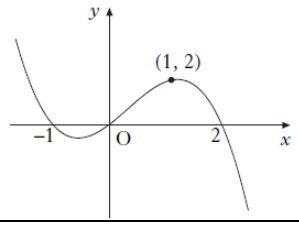
71 Functions f and g are defined on the set of real numbers by $f(x) = x^2 + 3$ and $g(x) = x + 4$. Find expressions for $f\big(g(x)\big)$ and $g\big(f(x)\big)$.	
72 The diagram shows part of the graph of $y = log_3(x - 4)$. The point $(q, 2)$ lies on the graph. What is the value of q? 	
73 Given that 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.	
74 An equilateral triangle of side 3 units is shown. The vectors **p** and **q** are as represented in the diagram. What is the value of **p.q**? 	
75 Convert $135°$ into radians and convert $\frac{2\pi}{3}$ into degrees.	
76 Calculate the distance between the points (4, -1) and (7, 3).	
77 A triangle has vertices P(1, 8), Q(-12, -2) and R(8, -6). Calculate the median PS.	
78 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?	
79 A sequence is generated by the recurrence relation $u_{n+1} = 0.7u_n + 10$. What is the limit of this sequence as $n \to \infty$?	
80 Calculate the shaded area shown in the diagram. 	

81 The diagram shows the graph with equation $y = k(x-1)^2(x+t)$. What are the values of *k* and *t*? 	
82 What is the solution of $x^2 + 4x > 0$, where *x* is a real number?	
83 Find x if $log_x 6 - 2log_x 4 = 1$.	
84 Solve the equation $sin2x - cosx = 0$ in the interval $0 \leq x \leq 180$.	
85 If *a* and *b* are acute angles such that $sina = \frac{4}{5}$ and $sinb = \frac{5}{13}$, find the value of $\sin(a+b)$.	
86 If $f(x) = \frac{1}{\sqrt[5]{x}}$, $x \neq 0$, what is $f'(x)$?	
87 Find the equation of the tangent to the curve with equation $y = x^3 + 2x^2 - 3x + 2$ at the point where $x = 1$.	
88 Find $\int (2x-1)^{\frac{1}{2}}\, dx$ where $x > \frac{1}{2}$.	
89 Find $\int_0^1 \frac{dx}{(3x+1)^{\frac{1}{2}}}$	
89 Express $3cosx° + 5sinx°$ in the form $kcos(x - a°)$ where *k*>0 and $0 \leq a \leq 90$.	

91 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 $f\big(g(x)\big)$ and $g\big(f(x)\big)$.	
92 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. 	
93 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.	
94 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.	
95 Find the exact value TAN $\frac{7\pi}{4}$	
96 Find the equation of the line which passes through the point (-1, 3) and is perpendicular to the line with equation $4x + y - 1 = 0$.	
97 A triangle has vertices A(-3, 1), B(4, 3) and C(6, -5). Find the equation of the altitude BP.	
98 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.	
99 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 $n \to \infty$?	
100 Calculate the shaded area shown in the diagram. 	

101 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 $(x - 1)$?	
102 If $x^2 - 8x + 7$ is written in the form $(x - p)^2 + q$, what is the value of q?	
103 Given that $log_{10}x = 3log_{10}y + log_{10}2$, express x in terms of y.	
104 Solve the equation $2cos3x = 1$, for $0 \leq x \leq 360$	
105 The diagram shows a right-angled triangle with sides and angles marked. Find the value of sin2x. 	
106 If $s(t) = t^2 - 5t + 8$, what is the rate of change of s with respect to t when $t = 3$?	
107 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. 	
108 Find $\int x(3x + 2)dx$.	
109 Find $f(x)$ given that $f'(x) = 2 - \frac{1}{x^2}$ and $f(1) = 8$.	
110 Write $1.5cosx° + 2sinx°$ in the form $kcos(x + a)°$, where $0 \leq a \leq 180$.	

111 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?	
112 The graph of $y = f(x)$ is shown . Sketch the graphs of $y = -f(x)$ and $y = -f(x) + 3$. 	
113 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.	
114 If $\boldsymbol{u} = \begin{pmatrix} -3 \\ 1 \\ 2t \end{pmatrix}$ and $\boldsymbol{v} = \begin{pmatrix} 1 \\ t \\ -1 \end{pmatrix}$ are perpendicular, what is the value of t?	
115 Prove the identity: $2cos^2x - 1 = 1 - 2sin^2x$	
116 A line makes an angle of $45°$ with the positive direction of the *x*-axis. What is its gradient?	
117 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.	
118 The point P(2, 3) lies on the circle $(x + 1)^2 + (y - 1)^2 = 13$. Find the equation of the tangent at P.	
119 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?	
120 Calculate the area enclosed between the curves $y = x^2 - x + 3$ *and* $y = 3 + 2x - x^2$. 	

121 The diagram shows the graph of a cubic. What is the equation of this cubic? 	
122 If $f(x) = (x-3)(x+5)$, for what values of x is the graph of $y = f(x)$ above the *x*-axis?	
123 Simplify $5log_8 2 + log_8 4 - log_8 16$	
124 Solve $4sin^2 x = 3$ for $0 \leq x \leq 360$.	
125 If $cosA = \frac{5}{13}$ and $sinB = \frac{4}{5}$, show that $\sin(A+B) = \frac{56}{65}$.	
126 Given that $f(x) = 4sin3x$, find $f'(0)$.	
127 A curve has equation $y = x - \frac{16}{\sqrt{x}}$, $x > 0$. Find the equation of the tangent at the point where $x = 4$.	
128 Find $\int (1-6x)^{-\frac{1}{2}}\, dx$ where $x < \frac{1}{6}$.	
129 $\frac{dy}{dx} = 6x^2 - 4x + 3$. If $y = 5$ when $x = 1$, find an equation for y.	
130 Express $8cosx° - 6sinx°$ in the form $kcos(x+a)°$ where $k > 0$ and $0 < a < 360$.	

131

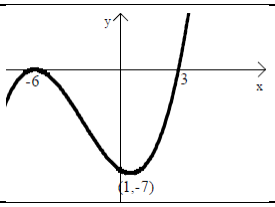
$f(x) = 3 - x$ and $g(x) = \frac{3}{x}, x \neq 0.$

Find $p(x) = f\big(g(x)\big).$

If $q(x) = \frac{3}{3-x}, x \neq 3$, find $p\big(q(x)\big)$ in its simplest form.

132

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



133

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

134

Find the magnitude between the origin and the point 'a' (3, 4, 0)

135

Prove the identity:

$$cosAtanA = sinA.$$

136

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

137

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

138

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

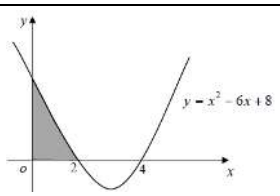
139

A sequence is generated by the recurrence relation $u_{n+1} = 0.4u_n - 30.$

What is the limit of the sequence as $\rightarrow \infty$?

140

Calculate the shaded area shown in the diagram.

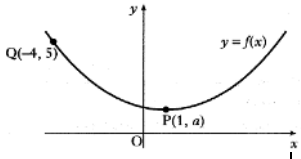


141 Show that $(x-4)$ is a factor of x^3-5x^2+2x+8. Hence, fully factorise and solve x^3-5x^2+2x+8.	
142 Solve $6-x-x^2<0$	
143 Before a forest fire was brought under control, the spread of the fire was described by a law of the form $A=A_0e^{kt}$ where A_0 is the area covered by the fire when it was 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.	
144 Solve $2\sin(2x-60)^\circ=1$ for $0\leq x\leq 360$.	
145 Using $75°=45°+30°$, show that $sin75°=\frac{\sqrt{6}+\sqrt{2}}{4}$.	
146 If $y=3x^{-2}+2x^{\frac{3}{2}}$, $x>0$, determine $\frac{dy}{dx}$.	
147 The parabola with equation $y=x^2-14x+53$ has a tangent at the point P(8, 5). Find the equation of this tangent.	
148 Find $\int\frac{(x^2-2)(x^2+2)}{x^2}\,dx$, $x\neq 0$	
149 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.	
150 Express $3cosx°+4sinx°$ in the form $kcos(x-a)°$ Hence, solve $3cosx°+4sinx°=5$	

151 $f(x) = 8x^2 - 5$ and $g(x) = 5 + x$

Find $f\big(g(x)\big)$ and $g\big(f(x)\big)$.

152 The diagram shows the graph of a function $y = f(x)$.
Sketch the graphs of:
$y = f(x - 4)$ and $y = 2 + f(x - 4)$.



153 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.

154 P is the point (-1, 2, -1) and Q is (3, 2, -4). Write down PQ in component form. Calculate the length of $\overrightarrow{PQ}$.
Find the components of a unit vector which is parallel to $\overrightarrow{PQ}$.

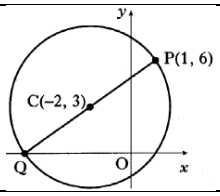
155 Prove the identity:

$$cos^2Q tan^2Q = 1 - cos^2Q$$

156 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.

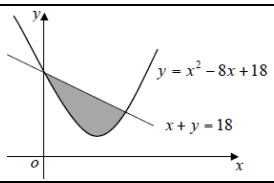
157 A triangle has vertices A(5, 5), B(-10, 0) and C(0, -10). Find the equation of the altitude from A.

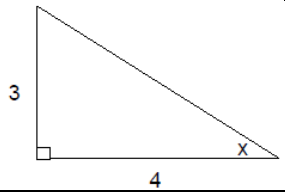
158 A circle has centre C(-2, 3) and passes through P(1, 6). Find the equation of the circle.



159 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.

160 Calculate the area between the line $y = x + y = 18$ and the curve $y = x^2 - 8x + 18$.



161 Show that $(x+2)$ is a factor of $f(x) = x^3 - 2x^2 - 4x + 8$ and hence fully factorise $f(x)$.	
162 Calculate the discriminant of the quadratic equation $2x^2 + 4x + 5 = 0$	
163 Solve the equation $log_4(5-x) - log_4(3-x) = 2$, $x < 3$.	
164 Find all the values of x in the interval $0 \leq x \leq 2\pi$ for which $tan^2(x) = 3$.	
165 Show that the exact value of $cos2x$ is $\frac{7}{25}$. 	
166 If $y = 3cos^4x$, find $\frac{dy}{dx}$.	
167 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.	
168 Find $\int \frac{4x^3-1}{x^2} dx, x \neq 0.$	
169 Find the value of $\int_0^2 \sin(4x+1)\, dx$.	
170 A curve has equation $y = 7sinx - 24cosx$. Express $7sinx - 24cosx$ in the form $ksin(x-a)$ where $k > 0$ and $0 \leq a \leq \frac{\pi}{2}$.	

171

$f(x) = 3x - 1$ and $g(x) = \frac{1}{x+1}$

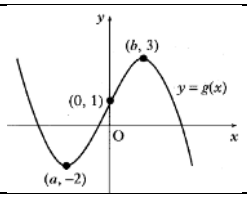
Find $f(g(x))$ and $g\big(f(x)\big)$.

State a suitable domain for $g\big(f(x)\big)$.

172 The diagram shows the graph $y = g(x)$.

a. Sketch $y = -g(x)$

b. Sketch $y = 3 - g(x)$



173

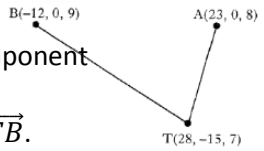
If $\boldsymbol{f} = 3\boldsymbol{i} + 2\boldsymbol{k}$ and $\boldsymbol{g} = 2\boldsymbol{i} + 4\boldsymbol{j} + 3\boldsymbol{k}$,

Find $|\boldsymbol{f} + \boldsymbol{g}|$.

174

Express the vectors $\overrightarrow{TA}$ and $\overrightarrow{TB}$ in component form.

Calculate the angle between $\overrightarrow{TA}$ and $\overrightarrow{TB}$.

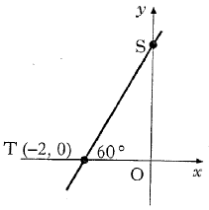


175 Prove the identity:

$(cosP° + sinP°)^2 = 2sinP°cosP° + 1$

176

Find the equation of the line ST, where T is the point (-2, 0) and angle STO is 60°.



177

Triangle ABC has vertices A(-1, 12), B(-2, -5) and C(7, -2). Find the equation of the altitude AE.

178

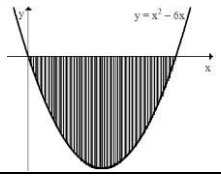
Show that the line with equation $y = 6 - 2x$ in a tangent to the circle with equation $x^2 + y^2 + 6x - 4y - 7 = 0$ and find the coordinates of the point of contact of the tangent and the circle.

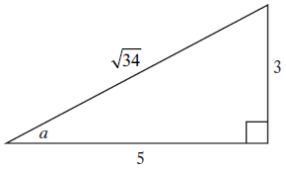
179 A sequence is defined by the recurrence relation $u_{n+1} = 0.2u_n + 5$ with $u_8 = 20$.

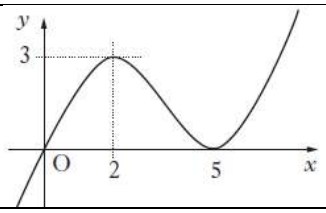
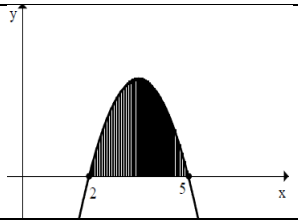
Calculate u_{10}.

180

Calculate the area enclosed between the curve $y = x^2 - 6x$ and the *x*-axis.



181 Show that $(3x + 1)$ is a factor of $g(x) = 3x^3 + 4x^2 - 5x - 2$. Hence fully factorise $g(x)$.	
182 Solve $1 - 2x - 3x^2 > 0$, where x is a real number.	
183 Solve the equation $log_2(x + 1) - 2log_2 3 = 3$.	
184 Solve $2tan3x + 2 = 0$ for $0 \leq x \leq 360$.	
185 A right-angled triangle has sides and angles as shown in the diagram. What is the value of $sin2a$? 	
186 Given that $y = \sin(x^2 - 3)$, find $\frac{dy}{dx}$.	
187 A curve has equation $y = 3x^2 - x^3$. Find the coordinates of the stationary points on this curve and determine their nature.	
188 Find $\int (2x + 9)^5 \, dx$	
189 Find $\int_0^2 \sqrt{4x + 1} \, dx$.	
190 Express $f(x) = \sqrt{3}cosx + sinx$ in the form $ksin(x + a)$, where $k > 0$ and $0 < a < \frac{\pi}{2}$.	

191 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?	
192 The diagram shows part of the graph of $y = f(x)$. Sketch the graph of $y = 2f(x) + 1$ 	
193 $\boldsymbol{p} = -\boldsymbol{i} + 3\boldsymbol{j} + 4\boldsymbol{k}$ and $\boldsymbol{q} = 7\boldsymbol{i} - \boldsymbol{j} + 5\boldsymbol{k}$ a) Express $\overrightarrow{PQ}$ in component form. b) Find the length of PQ.	
194 The vectors $\boldsymbol{u} = \begin{pmatrix} 1 \\ k \\ k \end{pmatrix}$ and $\boldsymbol{v} = \begin{pmatrix} -6 \\ 2 \\ 5 \end{pmatrix}$ are perpendicular. What is the value of k?	
195 Show that: $(1 + 2sinx)(1 - 2sinx) = 4cos^2x - 3$	
196 Find the equation of the line through the point (-1, 4) which is parallel to the line with equation $3x - y + 2 = 0$.	
197 A triangle has vertices P(-2, 2), Q(6, 6) and R(6, -4) Find the equation of the perpendicular bisector of PR.	
198 Find P and Q, the points of intersection of the line $y = 3x - 5$ and the circle C_1 with equation $x^2 + y^2 + 2x - 4y - 15 = 0$.	
199 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.	
200 Calculate the shaded area between the curve $y = -x^2 + 7x - 10$ and the *x*-axis. 	

Ques 1 - 20

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. $\sin(x+a) = \frac{4}{5}sinx + \frac{3}{5}cosx$
6. $\frac{dy}{dx} = 12x^2 + 10x - 3$
7. Max T.P at $(-1,17)$ and Min T.P. at $(3,-15)$
8. $\frac{-2x^{-3}}{3} + \frac{1}{5}sin5x + C$
9. $y = 4x^2 - 3x - 3$
10. $k = 2$ and $a = 30°$
11. $x \leq 3$
12. $a = 2 \quad b = 3$
13. 1: 2
14. 26
15. $sin60 = \frac{\sqrt{3}}{2} \quad tan\frac{\pi}{6} = \frac{1}{\sqrt{3}}$
16. $m = -1$
17. $y = -3x + 10$
18. $(x+7)^2 + (y-6)^2 = 36$
19. $u_{12} = 8.7$
20. Area = 32 square units

Ques 21 - 40

21. $f(x) = (x-1)(x+2)(x-1)$
22. $q = 5$
23. $x = 2$
24. $x = \frac{\pi}{6}, \frac{11\pi}{6}$
25. $cos2x = \frac{-3}{5}$
26. $f'(x) = 3x(4-3x^2)^{\frac{-3}{2}}$
27. *Max T.P.* at (-1, 4) and Min T.P. at (1, 0)
28. $\frac{8}{3}x^{\frac{3}{2}} - \frac{1}{2}x^{-2} + C$
29. $y = \frac{-1}{3}cos3x + \frac{7}{6}$
30. $\sqrt{2}\sin(x - \frac{\pi}{4})$
31. $f(g(x)) = 3x^2 - 5 \quad g(f(x)) = 9x^2 + 6x - 1$
32. $a = 3 \quad b = 3$
33. $k = 4$
34. $\overrightarrow{DE} = 3\overrightarrow{EF}$ so $\overrightarrow{DE}$ and $\overrightarrow{EF}$ are parallel. E is a common point so D,E,F are collinear.
35. Proof.
36. $3y + 5x = -13$
37. $m_{PS} = \frac{7}{4}$
38. $4y + 5x = 71$
39. $L = -400$
40. Area = $12\frac{3}{20}$ square units.

Ques 41 - 60

41. $Y = 3(x-1)(x-4)$
42. $x > 3 \quad x < -2$
43. $log_a 5$
44. $x = 0°, 60°, 300°, 360°$
45. $\sin(p+q) = \frac{2+2\sqrt{5}}{3\sqrt{5}}$
46. $\frac{dy}{dx} = 6x^5 + 24x^2$
47. $y = 6x - 18$
48. $-2\cos(2x+3) + C$
49. $9\frac{1}{3}$
50. $\sqrt{13}\sin(x - 303.7)$
51. 0.5
52. Correct shape, Min T.P at (-4, -4) Max T.P. at (-1, 1)
53. $\begin{pmatrix} 8 \\ -4 \\ -5 \end{pmatrix}$
54. $x = 1$
55. Proof
56. $m = \frac{1}{\sqrt{3}}$
57. $3y - x - 8 = 0$
58. Centre $(-4,-2)$ radius=$\sqrt{58}$
59. $u_3 = 29$

Ques 61 - 80

61. $(x-1)(x+4)(x+5)$
62. $k = \frac{9}{8}$
63. -4
64. $x = 60°, 132°, 228°, 300°$
65. $cos2a = \frac{7}{25}$
66. 14π
67. $y = -x + 1$
68. $\frac{x^{-3}}{-9} + C$
69. 1
70. $5\cos(x + 306.9°)$
71. $f(g(x)) = x^2 + 8x + 19 \quad g(f(x)) = x^2 + 7$
72. $q = 13$
73. 3:2
74. $\frac{9}{2}$
75. $120° = \frac{3\pi}{4}$ and $\frac{2\pi}{3} = 120°$
76. 5 units
77. $y = 4x + 4$
78. $J(-1,-2) \quad K(1,2)$
79. $l = 100/3$
80. $Area = \frac{27}{4}$square units

60. Area = $57\frac{1}{6}$ square units

Ques 81 - 100

81. $K = -2$ and $t = -5$
82. $x > 0 \quad x < -4$
83. $x = \frac{3}{8}$
84. $x = 30°, 90°, 150°$
85. $\sin(a+b) = \frac{63}{65}$
86. $f'(x) = -\frac{1}{5}x^{-\frac{6}{5}}$
87. $y = 4x - 2$
88. $\frac{(2x-1)^{\frac{3}{2}}}{3} + C$
89. $\frac{2}{3}$
90. $\sqrt{34}\cos(x - 59.0)°$
91. $f(g(x)) = 9x^2 - 24x + 17 \quad g(f(x)) = 3x^2 - 1$
92. $a = 4 \quad b = 2 \quad c = 1$
93. 3:2
94. $\theta = 72°$
95. **-1**
96. $y = \frac{1}{4}x + \frac{13}{4}$
97. $y = \frac{3}{2}x - 3$
98. Centre $(-1, -2)$ Radius $\sqrt{32}$
99. $L = \frac{28}{3}$
100. $Area = 9\ square\ units$

Ques 101 - 120

1014
102. $q = -9$
103 $x = 2y^3$
104. $x = 20°, 100°, 140°, 220°, 260°, 340°$
105. $sin2x = \frac{4}{5}$
106. 1
107 Max T.P. when $x = \frac{1}{3}$
108. $x^3 + x^2 + c$
109. $f(x) = 2x + \frac{1}{x} + 5$
110. $2.5\cos(x + 306.9)°$
111. $x \neq 3 \ and \ x \neq 4$
112 Correct shape drawn and labelled with (0,3), (3,1), (5, 3)
113. $Q(3, 1, -2)$
114. t=-3
115. Proof.
116. $m = 1$
117. $y = -2x + 2$
118. $y = -\frac{3}{2}x + 6$
119. $u_4 = 3$
120. 9/8

Ques 121 - 140

121. $y = -x(x+1)(x-2)$
122. $x < -5 \ and \ x > 3$
123. 1
124. $x = 60°, 120°, 240°, 300°$
125. Proof.
126. 12
127. $y = 2x - 12$
128. $-\frac{(1-6x)^{\frac{1}{2}}}{3} + C$
129. $y = 2x^3 - 2x^2 + 3x + 2$
130. $10\cos(x + 36.9)°$
131. $p(x) = 3 - \frac{3}{x}$ and $p(q(x)) = x$
132. $y = -2f(x)$ passing through (-6, 0), (1, 14), (3, 0) and $y = f(x-3)$ passing through (-3, 0), (4, -7), (6, 0)
133. $\overrightarrow{QR} = 2\overrightarrow{PQ}$ and Q is a common point so P, Q, R are collinear.
134. 5
135. Proof.
136. $y = -\frac{1}{2}x + \frac{13}{2}$
137. $y = 6x + 9$
138. $y = \frac{1}{4}x - \frac{7}{2}$
139. $L = -50$
140. Area = $\frac{20}{3}$ square units

Ques 141 - 160

141. $(x-4)(x-2)(x+1)$
142. $x < -3 \ and \ x > 2$
143. $k = 0.46$
144. $x = 45°, 105°, 225°, 285°$
145. Proof.
146. $\frac{dy}{dx} = -6x^{-3} + 3x^{\frac{1}{2}}$
147. $y = 2x - 11$
148. $\frac{x^3}{3} + 4x^{-1} + C$
149. $y = 2x^2 - 2x^3 + 5$
150. $x = 53.1°, 413.1°$
151. $f(g(x)) = 8x^2 + 80x + 195 \quad g(f(x)) = 8x^2$
152. $y = f(x-4)$ passing through $(0,5), (5, a)$ $y = 2 + f(x-4)$ passing through $(0,7), (5, a+2)$
153. AB:BC = 1:2
154. Unit vector = $\begin{pmatrix} \frac{4}{5} \\ 0 \\ \frac{-3}{5} \end{pmatrix}$
155. Proof.
156. m=3
157. $y = x$
158. $(x+2)^2 + (y-3)^2 = 18$
159. $L = 60$
160. $Area = \frac{343}{6}$ square units

Ques 161 - 180

161. $(x+2)(x-2)(x-2)$
162. $b^2-4ac=-24$
163. $x=\frac{43}{15}$
164. $x=\frac{\pi}{3},\frac{2\pi}{3},\frac{4\pi}{3},\frac{5\pi}{3}$
165. $Proof.$
166. $\frac{dy}{dx}=-12sinxcos^3x$
167. $Max\ T.$P at (-1, 17). Min T.P at (3, -15).
168. $2x^2+\frac{1}{x}+C$
169. $0.363\ radians$
170. $25\sin(x-1.287)$ (in radians)
171. $f(g(x))=\frac{-x+2}{x+1}\quad g(f(x))=\frac{1}{3x}$
172. $y=-g(x)\ passes\ through\ (a,-2),(0,-1),(b,-3)$
$y=3-g(x)$ passes through $(a,5),(0,2),(b,0)$
173. $|\boldsymbol{f}+\boldsymbol{g}|=\sqrt{66}$
174. $\theta=50.9$
175. Proof.
176. $y=\sqrt{3}x+2\sqrt{3}$
177. $y=-3x+9$
178. Point of contact is $(1,4)$
179. $u_9=9\quad u_{10}=6.8$
180. Area = 36 square units

Ques 181 - 200

181. $3(3x+1)(x+2)(x-1)$
182. $-1<x<\frac{1}{3}$
183. $x=71$
184. $x=45°,105°,165°,225°,285°,345°$
185. $sin2a=\frac{15}{17}$
186. $\frac{dy}{dx}=2xcos(x^2-3)$
187. $Min\ T.P\ at\ (0,0)\ \ Max\ T.P\ at\ (2,4)$
188. $\frac{(2x+9)^6}{12}+C$
189. $\frac{13}{3}$
190. $2\sin(x+\frac{\pi}{3})$
191. $x\neq-8\ ,\quad x\neq2$
192. $y=2f(x)+1$ passes through $(0,1),(2,7),(5,1)$
193. $\overrightarrow{PQ}=\begin{pmatrix}8\\-4\\1\end{pmatrix}\quad|\overrightarrow{PQ}|=9$
194. $k=\frac{6}{7}$
195. Proof.
196. $y=3x+7$
197. $3y=4x-11$
198. $P(1,-2)\quad Q(3,4)$
199. $u_1=16\quad u_2=20\quad u_3=21$
200. Area = $\frac{9}{2}$ square units