Answer **all** the questions.

1 Given that $\cos A = \frac{3}{5}$ and $\tan B = -\frac{5}{12}$ where A and B lies in the same quadrant, find the exact value of

(i) $\tan A$, [1]

(ii) $\sin(\ B)$, [1]

(iii) $\operatorname{cosec}(180^\circ - B)$. [2]

2 Solve the equation $6\sin x + 4\tan x = 2\sec x + 3$ for $-180^\circ \le x \le 180^\circ$. [4]

3 The curve $y^2 = 72x$ intersects the curve $y = 3x^2$ at A and B. Find the equation of the line joining A and B. [5]

4 Find the range of values of m for which the curve $y = (m-3)x^2 + 3x + (m+1)$ lies entirely above the x-axis. [5]

5 Express $\frac{4x^3 - 2x^2 - 13x + 13}{2x^2 - 2}$ in its partial fractions. [5]

6 A prism has a regular hexagonal cross-section with sides of length $\left(2+\sqrt{3}\right)$ cm. Given that the volume of the prism is $\frac{3}{2}\left(17\sqrt{3}+30\right)$ cm³, find the height of prism, leaving your answer in the form of $\left(a\sqrt{3}+b\right)$ cm where a and b are integers. [6]

7 (i) Sketch, on the same set of axes, the graph of $y = 2\cos 3x + 1$ and $y = \tan x$ for $0 \le x \le \pi$. [4]

(ii) Hence, state the number of solutions to the following equations.

(a) $\tan x = 2\cos 3x + 1$, [1]

(b) $|2\cos 3x + 1| = \tan x$. [1]

8 (i) Show that the expression $|4x-6|+|9-6x|$ can be simplified to the form $k|2x-3|$ where k is an integer. [2]

(ii) Sketch the graph of $y=|4x-6|+|9-6x|-2$. [3]

(iii) Hence, determine the range of values of m for which the line $y=mx-5$ cuts the graph $y=|4x-6|+|9-6x|-2$ at 2 points. [2]

9 (i) By expressing $y=\ln\sqrt{\left(\frac{x^2+6x}{3x^2+16x-12}\right)^3}$ in the form of $y=a\left[\ln f(x)-\ln g(x)\right]$, where a is a constant and $f(x)$ and $g(x)$ are linear functions, find the first derivative of y. Express your answer as a single fraction. [5]

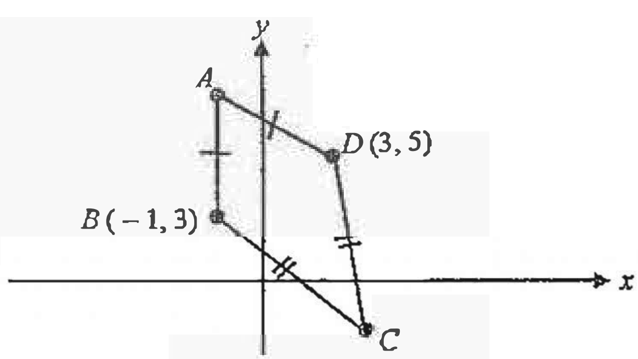
(ii) Hence, explain why the curve $y=\ln\sqrt{\left(\frac{x^2+6x}{3x^2+16x-12}\right)^3}$ has no turning points for $x>\frac{3}{2}$. [2]

10 (a) Show that $\frac{d}{dx}\left[\cot^2\left(\frac{\pi}{2}-2x\right)\sin 2x\right]=\frac{2\sin^2 2x(2+\cos^2 2x)}{\cos^3 2x}$. [4]

(b) Find the exact value of $\int_0^{\frac{\pi}{3}}(5\tan^2 2x+3)\,dx$. [3]

11 Find the coordinates of the stationary point(s) of the curve $y=x^4-3x^3+1$ and determine the nature of the stationary point(s). [8]

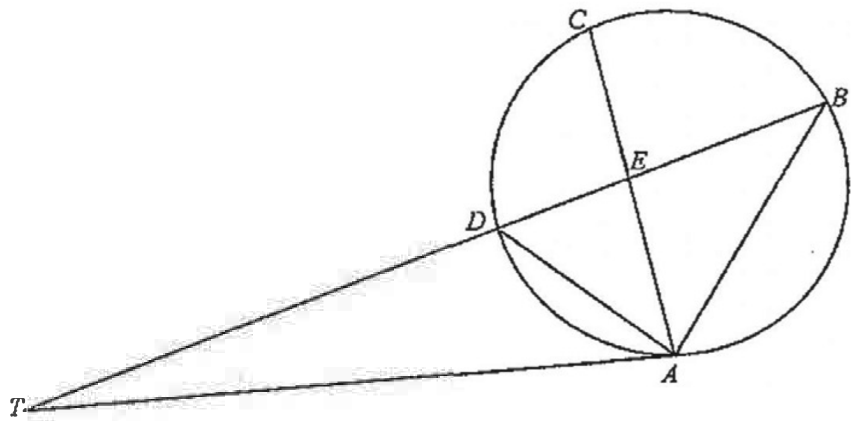
12 In the diagram below, $ABCD$ is a kite where the coordinates of B is $(-1,3)$ and the coordinates of D is $(3,5)$.



(i) Given that A lies vertically above B, find the coordinates of A. [4]

(ii) Given that the ratio of the area of triangle ABD : area of triangle BCD = 2 : 3, find the coordinates of C. [4]

13 In the diagram below, A, B, C and D are points on the circle and AT is a tangent to the circle. BDT is a straight line such that $BD : BT = 2 : 5$. AC meets BD produced at E such that $BE : ED = 3 : 2$.



(i) Prove that triangle ATD is similar to triangle BTA. [3]

(ii) Prove that $2AT^2 = 5(TB \times BE)$. [5]

End of Paper 1