1 The line $x+y=h$, where h is a constant, is tangent to the curve $y=3x^2+5x$ at the point R. Find the value of h and the coordinates of R. [5]

2 Without using a calculator, find the values of the integers m and n for which the solution of the equation $x\sqrt{12}=x\sqrt{\frac{2}{27}}+\sqrt{108}$ is $\frac{m+n\sqrt{2}}{161}$. [5]

3 Express $\frac{x^2+5}{(x^2-1)(x+1)}$ in partial fractions. [5]

4 (a) The graph of $y=|3x+q|$ passes through the point $(-2, 5)$, find the possible values of q. [2]

(b) (i) Solve the inequality $|3x-5|>4$. [2]

(ii) Sketch the graph of $y=|3x-5|-4$ for $0\leq x<2$. [2]

5 (i) Sketch the graph of $y^2=\frac{x}{32}$ where $x\geq 0$. [2]

(ii) Find the x-coordinates of the points of intersection when the curve, $y=x^3$ meets the curve $y^2=\frac{x}{32}$. [3]

6 (a) Given that $A=\tan^{-1}(-5)$, where A is the principal value, find the exact value of

(i) $\cot A$ [1]

(ii) $\sec A$ [1]

(iii) $\sin(-A)$ [1]

(b) Sketch the graph of $y=4\tan\left(\frac{x}{3}\right)$ where $-\pi\leq x\leq\pi$. [3]

7 (a) Prove that $\sec x \operatorname{cosec} x=\cot x+\tan x$. [3]

(b) Solve the equation $\cos^2 y-\sin^2 y=4\sin y\cos y$ for $-180°\leq y\leq 180°$. [5]

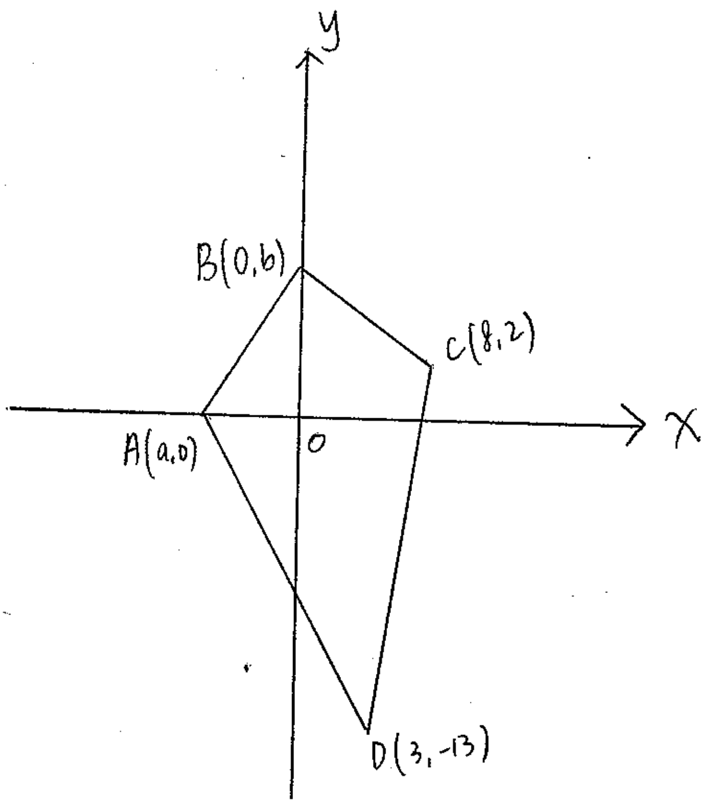
8 The diagram shows a kite $ABCD$ in which the coordinates of C and D are (8, 2) and (3,–13) respectively. Given that the point $A(a, 0)$ and $B(0, b)$ lie on the x-axis and y-axis respectively, find the

(i) gradient of CD, [1]

(ii) coordinates of A and of B, [4]

(iii) midpoint of AC and [1]

(iv) area of the kite. [2]



9 (a) Find the equation of the tangent to the curve $y=(2x-1)^3$, for $x>\frac{1}{4}$, which is perpendicular to the line $3y+2x=9$. [7]

(b) A curve is such that $\frac{dy}{dx}=6\cos 2x+1$ and passes through the point $\left(\frac{\pi}{4},\frac{\pi}{4}+1\right)$. Find the equation of the curve. [3]

10 **(a)** **(i)** Find $\frac{d}{dx}\left(e^{x^2}\right)$. [1]

(ii) Hence, evaluate $\int_0^1 xe^{x^2}\,dx$. [2]

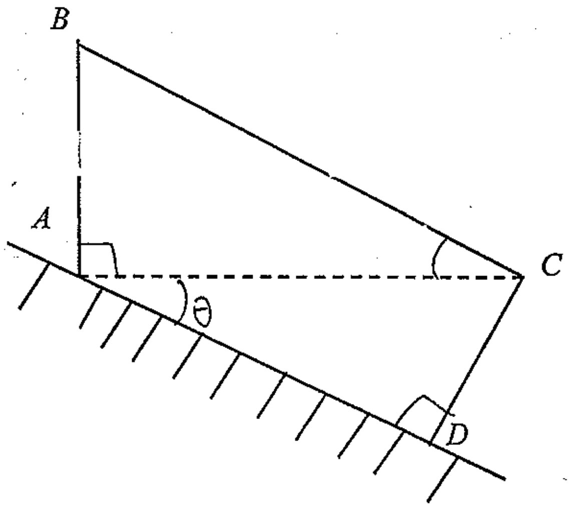
(b) Given that $f(x)=\frac{\ln x}{x-1}$ for $x>1$.

(i) Show that $f'(x)=\frac{x(1-\ln x)-1}{x(x-1)^2}$. [2]

(ii) Hence, find the equation of the normal to the curve $y=f(x)$ at the point where $x=2$. [3]

11 Find the positive number, x, when added to twice its reciprocal gives a minimum sum. [5]

12 The diagram shows the plan of a field. On one side of the field is a wall AD. The farmer wants to fence up the field represented by the solid lines, AB, BC and CD.



Angles BAC and CDA are right angles, $\angle ACB=\angle DAC=\theta$ radians, and $BC=50$ m.

(i) Show that the total length of fencing, P m, is given by $P=25\sin 2\theta+50\sin\theta+50$. [2]

(ii) Determine the stationary value of P. [5]

(iii) Give a reason why this value of P is a maximum value. [2]

END OF PAPER