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## RESOURCEFUL MOCK 2017

## U.A.C.E

MATHEMATICS PAPER 1
TIME: 3 HOURS

Answer all questions in section $\boldsymbol{A}$ and any five in section $\boldsymbol{B}$
Any additional question(s) answered will not be marked
All necessary working must be shown clearly.
Begin each answer on a fresh sheet of paper.
Graph paper is provided.
Silent non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

## SECTION A

1. Solve the simultaneous equations

$$
\begin{align*}
& X-2 y-2 z=0 \\
& 2 X+3 y+Z=1 \\
& 3 X-y-3 Z=3 \tag{5mks}
\end{align*}
$$

2. Find the equation of a line through $\mathrm{S}(1,0,2)$ and $\mathrm{T}(3,2,1)$ in the form $r=a+$ $\lambda b$. Hence deduce the Cartesian equation of the line. [5mks]
3. Find $\int X\left(1-X^{2}\right)^{1 / 2} d x$
4. Show that $\tan ^{-1}(1 / 2)+\tan ^{-1}\left(\frac{1}{5}\right)=\tan ^{-1}\left(\frac{7}{9}\right)$
5. If $y=\frac{3-2 x}{4+X^{2}}$ find the range of possible values of $Y$ for real $X$.
6. Differentiate $e^{a x^{2}}$ with respect to X .
7. Given the points $0(0,0)$ and $P(4,2)$. $A$ is the locus of the points such that $O A$ : $A P$ $=1: 2 . Q$ is the mid point of AP. Find the locus of Q in its simplest form. [ 5 mks ]
8. Solve the equation $\log _{2} X-\log _{X} 8=2$

## SECTION B

9. a) The function $F(x)=X^{3}+P X^{2}-5 x+q$ has a factor $(x-2)$ and has a value of 5 when $X=-3$, find P and q .
b) The roots of the equation $a x^{2}+b x+C=0$ are $\propto$ and $\beta$. Form the equation whose roots are ${ }^{\alpha} / \beta$ and $\beta / \alpha$
c) Simplify $\frac{\sqrt{3}-2}{(2 \sqrt{3}+3)}$ in the form $P+q \sqrt{3}$ where $P, q$ are rational numbers. [3mks]
10. If $y=\tan \frac{(X+1)}{2}$ show that $\frac{d^{2} y}{d x^{2}}=y \frac{d y}{d x}$
b) Find the equation of the tangent to the curve $X^{2}+Y^{2}-2 x y=4 X$ at $(1,-1)$
11. a) Given that $\mathrm{OP}=\left(\begin{array}{c}4 \\ -3 \\ 5\end{array}\right)$ and $\mathrm{OQ}=\left(\begin{array}{l}1 \\ 0 \\ 2\end{array}\right)$. Find the coordinates of the point R such that $\overline{\mathrm{PR}}: \mathrm{PQ}=1: 2$ and the points PQ and R are collinear.
b) Show that vector $5 i-2 j+K$ is perpendicular to the line $r=i-4 j+$ $t(2 i+3 j-4 K)$
c) Find the equation of the plane through the point with position vector $5 i-2 j+$ $3 K$ perpendicular to the $3 i+4 j-K$.
12. a) Find the first three terms of the expansion $(2-x)^{6}$ and use it to find $(1.998)^{6}$ correct to the decimal places.
b) Expand $\left(1-3 X+2 X^{2}\right)^{5}$ in ascending powers of $X$ as far as the $X^{2}$ term.
13. Solve
a. $4 \operatorname{Sin}^{2} \theta-12 \operatorname{Sin} 2 \theta+35 \operatorname{Cos}^{2} \theta=0$ for $0^{\circ} \leq \theta \leq 90^{\circ}$
[6mks]
b. $3 \operatorname{Cos} \theta-2 \operatorname{Sin} \theta=2$ for $0 \leq \theta \leq 360$
[6mks]
14. a) Given that the complex number $Z$ and its conjugate $\bar{Z}$ satisfy the equation $Z \bar{Z}+$ 2i $Z=12+6 i$. Find $Z$.
b) One root of the equation $Z^{3}-3 Z^{2}-9 Z+13=0$ is $2+3 i$. Determine the other roots.
[5mks]
15. Resolve $Y=\frac{X^{3}+5 X^{2}-6 X+6}{(X-1)^{2}\left(X^{2}+2\right)}$ into partial fractions. Hence find $\int Y d x$ and $\frac{d y}{d x}$

## END

