

UNEB UACE PURE MATHS 2016

Answer all questions in this section

1. Without using mathematical tables or a calculator, find the value of

$$\frac{(\sqrt{5}+2)^2 - (\sqrt{5}-2)^2}{8\sqrt{5}}$$

2. Find the angle between the lines $2x - y = 3$ and $11x + 2y = 13$.

3. Evaluate

$$\int_{1/2}^1 10x\sqrt{1-x^2} dx$$

4. Solve the equation

$$\frac{dy}{dx} = 1 + y^2$$

given that $y = 1$ when $x = 0$.

5. Given that $2x^2 + 7x - 4$, $x^2 + 3x - 4$ and $7x^2 + ax - 8$ have common factor find the:

a) factors of $2x^2 + 7x - 4$ and $x^2 + 3x - 4$

b) value of a in $7x^2 + ax - 8$

6. Solve the equation $\sin 2\theta + \cos 2\theta \cos 4\theta = \cos 4\theta \cos 6\theta$ for

$$0 \leq \theta < \frac{\pi}{4}$$

7. Using small changes, show that

$$244)^{1/5} = 3 \frac{1}{405}$$

8. Three points A(2, -1, 0), B (-2, 5, -4) and C are on a straight line such that $3\vec{AB} = 2\vec{AC}$. Find the coordinates of C.

SECTION B

Answer any five questions from this section. All questions carry equal marks.

9. a) If

$$Z_1 = \frac{2i}{1+3i} \text{ and } Z_2 = \frac{3+2i}{5}$$

find $|Z_1 - Z_2|$

b) Given the complex number $Z = x + iy$;

i) find $\frac{Z+i}{Z+2}$

ii) show that the locus of $\frac{Z+i}{Z+2}$ is a straight line when its imaginary part is zero. State the gradient of the line.

10. a) Solve the equation $\cos 2x = 4 \cos^2 x - 2 \sin^2 x$ for $0^\circ \leq x < 180^\circ$.

b) Show that if $\sin(x + a) = P \sin(x - a)$ then

$$\tan x = \left(\frac{P+1}{P-1} \right) \tan a.$$

hence solve the equation $\sin(x + 20^\circ) = 2 \sin(x - 20^\circ)$ for $0^\circ \leq x < 180^\circ$.

11. Given that

$$x = \frac{t^2}{1+t^3} \text{ and } y = \frac{t^3}{1+t^3}, \text{ find } \frac{d^2 y}{dx^2}$$

12. a) Line A is the intersection of two planes whose equations are

$$3x - y + z = 2 \text{ and } x + 5y + 2z = 6.$$

Find the Cartesian equation of the line.

b) Given that line B is perpendicular to the plane $3x - y + z = 2$ and passes through the point $C(1,1,0)$, find the:

i) Cartesian equation of line B

ii) angle between line B and line A in (a) above.

13. a) Find

$$\int \frac{1+\sqrt{x}}{2\sqrt{x}} dx.$$

b) The gradient of the tangent at any point on a curve is

$$x - \frac{2y}{x}$$

The curve passes through the point $(2,4)$. Find the equation of the curve.

14. a) The point $P(at_1^2, 2at_1)$ and $Q(at_2^2, 2at_2)$ are on the parabola $y^2 = 4ax$. OP is perpendicular to OQ , where O is the origin. Show that $t_1 t_2 + 4 = 0$.

b) The normal to the rectangular hyperbola $xy = 8$ at a point $(4,2)$ meets the asymptotes at M and N . Find the length of MN .

15. a) Prove by induction

$$1 \cdot 3 + 2 \cdot 4 + \dots + n(n+2) = \frac{1}{6}n(n+1)(2n+7)$$

for all integral values of n .

b) A man deposits Shs 150,000 at the beginning of every year in a micro-finance bank with the understanding that at the end of seven years he is paid back his money with 5% per annum compound interest. How much does he receive?

16. a) If $x^2 + 3y^2 = k$, where k is a constant, find at the point $(1,2)$.

b) A rectangular field of area 7200m^2 is to be fenced using a wire mesh. On one side of the field, is a straight river. This side of the field is not of amount of wire mesh to be used.

END.

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