

## Pure math – Model 2

1. The coefficient of  $T_5$  in the expansion of  $(1 + 2x)^{10}$  according to the ascending power of  $x$  is ...

- a)  $16 \times {}^{10}C_5$                       b)  $\frac{1}{16} \times {}^{10}C_5$   
c)  $16 \times {}^{10}C_4$                       d)  $\frac{1}{16} \times {}^{10}C_4$

2. The distance between the point  $(6,7,8)$  and the  $y$ -axis is ...

- a) 12                      b) 10                      c) 8                      d) 6

3. If  $\sin x = \cos y$ , where  $x, y \in ]0, \pi[$ , then  $\frac{dy}{dx} = \dots$

- a) zero                      b) -1                      c)  $\frac{\pi}{2}$                       d)  $\frac{-\cos x}{\sin y}$

4.  $\int e^{\sec^2 x - \tan^2 x} dx = \dots$

- a) zero                      b)  $e^x$                       c)  $ex$                       d)  $e$

5. The value of the term free of  $x$  in the expansion  $\left(\frac{x+1}{x^{2/3}-x^{1/3}+1} - \frac{x-1}{x-x^{1/2}}\right)^{10}$  equals ...

- a) 210                      b) 105                      c) 70                      d) 112

6. If  $\vec{A} = (-2,0,3)$ ,  $\vec{B} = (4,2,-5)$ , then  $\overrightarrow{AB} = \dots$

- a)  $(-6,-2,8)$                       b)  $(2,2,-2)$   
c)  $(6,2,-8)$                       d)  $(1,1,-1)$

7. If  $y = x \sin x$ , then  $x \frac{d^3y}{dx^3} + x \frac{dy}{dx} = \dots$

- a)  $2x$                       b)  $2y$                       c)  $3xy$                       d)  $-2y$

8. The volume of the solid generated by rotating the region bounded between  $y = x^3 + 1, y = 0, x = 1$  a complete revolution about the  $x$ -axis = ... cubic units

- a)  $\frac{14}{23}\pi$       b)  $\frac{16}{7}\pi$       c)  $\frac{20}{23}\pi$       d)  $\frac{11}{23}\pi$

9. The value of  $\log_{16} \left( \frac{4+\omega+2\omega^2}{\omega^2+1} + \frac{\omega^2-1}{2+\omega+2\omega^2} \right) = \dots$

- a)  $\frac{1}{4}$       b)  $\frac{1}{2}$       c)  $\frac{1}{3}$       d) 1

10. If  $\|\vec{A} \times \vec{B}\|^2 + (\vec{A} \cdot \vec{B})^2 = 144$  and  $\|\vec{A}\| = 4$ , then  $\|\vec{B}\| = \dots$

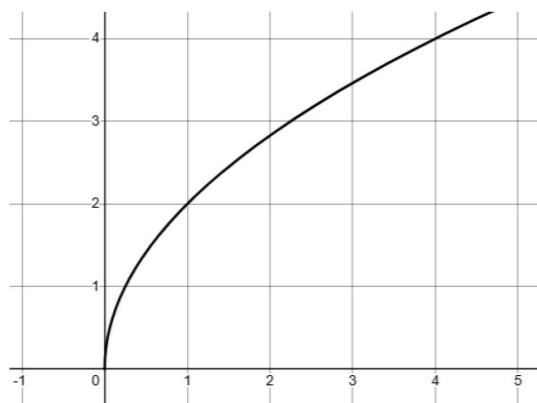
- e) 3      b) 4      c) 5      d) 6

11. A point moves along the curve  $x^2 + y^2 - 4x + 8y - 6 = 0$ , and the rate of change of the  $x$ -coordinate at the point (3,1) is 4, then the rate of change of the  $y$ -coordinate is...

- a)  $\frac{3}{5}$       b)  $\frac{4}{5}$       c)  $\frac{-4}{5}$       d)  $\frac{-3}{5}$

12. The area of the region bounded by the curve  $y = \sqrt{kx}$  and the straight lines  $x = 9$  and  $y = 0$  is .... Square units

- a) 6      b) 12  
c) 24      d) 36



13. The exponential form of the complex number  $z = 2 + 2\sqrt{3}i$  is ...

- a)  $4e^{-\frac{\pi}{3}i}$       b)  $4e^{\frac{\pi}{3}i}$       c)  $4e^{-\frac{\pi}{6}i}$       d)  $4e^{\frac{\pi}{6}i}$

14.  $\sin^2 \theta_x + \sin^2 \theta_y + \sin^2 \theta_z = \dots$

- a) -1                      b) 1                      c) 2                      d) 3

15. The curve of the function  $f(x) = x^4 - 24x^2 + 4$  is convex downward on the interval ...

- a)  $] -\infty, 2[$                       b)  $] -\infty, -2]$   
c)  $] -2, 2[$                       d)  $R - [-2, 2]$

16. The trigonometric form of the complex number  $z = -\sqrt{3} + i$  is ...

- a)  $3(\cos 150^\circ + i \sin 150^\circ)$   
b)  $2(\cos 150^\circ + i \sin 150^\circ)$   
c)  $2(\sin 150^\circ + i \cos 150^\circ)$   
d)  $\cos 150^\circ + i \sin 150^\circ$

17. The equation of the plane passing through the point  $(1, -2, 5)$  and its normal vector  $(2, 1, 3)$  is ...

- a)  $2x + y + 3z = 1$   
b)  $2x + y + 3z = 15$   
b)  $x - 2y + 5z = 15$   
d)  $x + y + z = 4$

18. The function  $f(x) = \frac{x^2+x+1}{x+1}$  is decreasing on ...

- a)  $[-2, 0]$                       b)  $] -1, \infty[$                       c)  $] -2, \infty[$                       d)  $] -2, 0[-\{1\}$

### Essay Questions

19. If  $a = 2 + 3\omega$ ,  $b = 2 + 3\omega^2$ , then Find the value of  $ab$

20. The sum of three numbers is 36, and the greatest number is twice the smaller, find the three numbers if Their product is maximum.

## Pure math – Model 1

1. If  $(1, \omega, \omega^2)$  are the cubic roots of 1, then  $(\omega + \omega^2 + \dots + \omega^{100}) = \dots$

- a) 1                      b)  $\omega$                       c)  $\omega^2$                       d) zero

2. If  $\theta, \theta, \beta$  are directed angles of  $\vec{A}$  and  $\sin^2 \beta = 3\sin^2 \theta$ , then  $\cos^2 \theta = \dots$

- a)  $\frac{3}{5}$                       b)  $\frac{2}{5}$                       c)  $\frac{1}{5}$                       d)  $\frac{1}{2}$

3. If  $n = \ln x, y = e^n$ , then  $\frac{dy}{dx} = \dots$

- a) Zero                      b) 1                      c) 2                      d) 3

4.  $\int 6xe^{3x^2+1} \cdot dx = \dots + c$

- a)  $e^{x^2+1}$                       b)  $e^{3x^2}$                       c)  $e^{3x^2+1}$                       d)  $\frac{1}{e^{x^2+1}}$

5. In the expansion of  $(3 + 2x)^8 + (3 - 2x)^8$  at  $x = \frac{1}{6}$ , Then middle term =  $\dots$

- a) 110                      b) 120                      c) 130                      d) 140

6. If the point  $(k, 4, 5)$  is at equal distances from the  $x$  and  $z$  axes, then  $k = \dots$

- a)  $\pm 1$                       b)  $\pm 3$                       c)  $\pm 4$                       d)  $\pm 5$

7. If  $x^2y^3 = 8$ , then  $\frac{dy}{dx} = \dots$  at  $x = -1$

- a)  $\frac{4}{3}$                       b)  $\frac{-4}{3}$                       c)  $\frac{3}{4}$                       d)  $\frac{1}{2}$

8.  $\int \frac{(\ln x)^2}{x} dx = \dots + c$

- a)  $\frac{1}{3}(\ln x)^3$                       b)  $\frac{1}{2}(\ln x)^3$                       c)  $\ln x$                       d)  $\ln x^2$

9. If the middle term in the expansion of  $(1 + x)^{10}$  is twice the seventh term, then  $x = \dots$

- a) 0.2                      b) 0.4                      c) 0.6                      d) 0.8

10. If  $\overrightarrow{AB} = -3\hat{i} + 3\hat{j} + 7\hat{k}$ , and  $\overrightarrow{BC} = \hat{j} + 5\hat{k}$ , then  $\|\overrightarrow{AC}\| = \dots$

- a) 8                          b) 10                          c) 12                          d) 13

11. If  $x = 3t^2 - 1$ ,  $y = t^3 + 2$ , then  $\frac{d^2y}{dx^2} = \dots$  at  $t = 4$

- a) 48                          b)  $\frac{1}{24}$                           c)  $\frac{1}{48}$                           d) 24

12. The volume of the solid generated by rotating the region bounded by the curve  $y = x(x - 2)$  a complete cycle about the  $x$ -axis =  $\dots$  cubic unit

- a)  $\frac{16}{15}\pi$                       b)  $\frac{19}{15}\pi$                       c)  $\frac{17}{15}\pi$                       d)  $\frac{15}{17}\pi$

13. The trigonometric form of the complex number  $z = \frac{5-\sqrt{3}i}{\sqrt{3}-2i}$  is ....

- a)  $\cos \frac{\pi}{3} + i\sin \frac{\pi}{3}$                       b)  $\cos \frac{\pi}{4} + i\sin \frac{\pi}{4}$   
c)  $2 \left( \cos \frac{\pi}{6} + i\sin \frac{\pi}{6} \right)$                       d)  $3 \left( \cos \frac{\pi}{3} + i\sin \frac{\pi}{3} \right)$

14. The equation of the plane passing through the point (1,2,3) and parallel to both the  $x$  and  $y$  axes is ...

- a)  $x + y = 3$                       b)  $x = 1$                       c)  $y = 2$                       d)  $z = 3$

15. A point is moving according to the relation  $S = 3t^3 + 3t^2 - 4$ , then  $\frac{ds}{dt} = \dots$  at  $t = 3$

- a) 77                          b) 88                          c) 99                          d) 111

16. The two square roots of the number  $z = 3 + 4i$  is ...

- a)  $\pm(2 + i)$                                   b)  $\pm(2 + \sqrt{3}i)$   
c)  $\pm(1 + \sqrt{3}i)$                               d)  $\pm(1 + i)$

17. The direction vector of the straight line  $\frac{x-2}{3} = \frac{y+3}{2}, z = 4$  is ...

- a) (3,2,4)          b) (3,2,0)          c) (2, -3,4)          d) (2, -3,0)

18 If  $f: f(x) = \sqrt[3]{x^2 - 6x}$ , then the number of critical points of the curve of  $f$  is ...

- a) Zero          b) 1          c) 2          d) 3

**Essay Questions:**

19. If  $k \in R$ , then find the value of

$$\left(k - \frac{k+1}{\omega+1} + \omega^2(k+1)\right)^8$$

20. The perimeter of a circular sector is 30 cm, find its radius when its area is maximum.