

1.  $\sqrt{-25} =$   
 A.  $\pm 25i$                       B.  $\pm 5i$                       C.  $5i$                       D.  $i$
2.  $\sum_{n=1}^5 i^n =$   
 A.  $-i$                       B.  $i$                       C.  $1$                       D.  $5$
3. The sequence  $\langle a_n \rangle = \frac{20-3n}{n+4}$  converges to  
 A.  $20$                       B.  $4$                       C.  $-3$                       D.  $-4$
4. A term in the expansion of  $\left(3x^2 - \frac{1}{x}\right)^{12}$  is  $\binom{12}{k}(3x^2)^{12-k}\left(\frac{-1}{x}\right)^k$   
 The value of  $k$  for the constant term is  
 A.  $2$                       B.  $3$                       C.  $8$                       D.  $12$
5. The average of the two positive integers  $m$  and  $n$  is 100. The largest possible value of  $n$  is  
 A.  $99$                       B.  $100$                       C.  $198$                       D.  $199$
6. The coordinates of the point of inflection of  $y = (x-1)^3(x-3)^2$  which lies on the  $x$ -axis is  
 A.  $(1,0)$                       B.  $(2,0)$                       C.  $(3,0)$                       D.  $(6,0)$
7. The function  $y = |x-1|$  is not differentiable at the point  
 A.  $(0,0)$                       B.  $(1,0)$                       C.  $(0,1)$                       D.  $(1,1)$
8. What is the minimum value of  $y = 3\sin x - 4\cos x$ ?  
 A.  $-1$                       B.  $-3$                       C.  $-5$                       D.  $-7$
9. The smallest positive value of  $\theta$  at which the function  $y = 12\sin(\theta + 30^\circ)$  is maximum is  
 A.  $\theta = 30^\circ$                       B.  $\theta = 60^\circ$                       C.  $\theta = 90^\circ$                       D.  $\theta = 150^\circ$
10. The equation of the horizontal asymptote of bottom heavy functions is  
 A.  $x = 0$                       B.  $x = 1$                       C.  $y = 0$                       D.  $y = 1$

11. If Goundar rolls a pair of standard 6-sided fair dice, what is the probability that the sum of the two numbers he rolls is a power of 2?

- A. 0.25                      B. 0.5                      C. 0.75                      D. 1

12. In a certain population, it is found that 25% can roll their tongue. The probability that in a random sample of 15, exactly 6 will be able to roll their tongues is

- A.  $\binom{15}{6}(0.25)^6(0.75)^9$     B.  $\binom{15}{6}(0.25)^9(0.75)^6$     C.  $(0.25)^6(0.75)^9$     D. 1

13. The function  $y = \frac{x^2 - 9}{x - 3}$  is discontinuous at

- A.  $(3, \infty)$                       B.  $(3, 0)$                       C.  $(3, 6)$                       D.  $x = \pm 3$

14. The range of the function  $y = 3 + \sin x$  is

- A.  $2 \leq y \leq 4$                       B.  $1 \leq y \leq 3$                       C.  $2 \leq y \leq 3$                       D.  $1 \leq y \leq 4$

**Use the following information to answer questions 15 and 16.**

A particle moves  $s$  metres in  $t$  seconds where  $s = 3t^2 - 4t + 10$

15. The initial displacement is

- A. 3 m                      B. 4 m                      C. 7 m                      D. 10 m

16. The acceleration when  $t = 3$  s is

- A. 3 m/s<sup>2</sup>                      B. 4 m/s<sup>2</sup>                      C. 6 m/s<sup>2</sup>                      D. 10 m/s<sup>2</sup>

17. For the function  $y^2 = 2x$ ,  $\frac{dy}{dx}$  equals

- A.  $y^{-1}$                       B. 2                      C.  $y$                       D.  $y^{-2}$

18. For the function  $f(x)$ ,  $f''(x) = -2x$ . The function  $f(x)$  is concave up in the interval

- A.  $x \leq 0$                       B.  $x < 0$                       C.  $x > 0$                       D.  $x \geq 0$

19. The area enclosed by the line  $y = x$  and the function  $y = x^3$  in quadrant 1 is equal to

- A. 0.25                      B. 0.5                      C. 0.75                      D. 1.25

20. If  $y = e^3$  then  $\frac{dy}{dx}$  equals

- A.  $e^3$                       B.  $3e^2$                       C.  $e^2$                       D. 0

21. The domain of  $y = \sin^{-1} x$  is

- A.  $-1 \leq x \leq 1$                       B.  $-1 < x < 1$                       C.  $-1 < x \leq 1$                       D. Real numbers

22. If  $f(x) = x$  and  $g(x) = 2x$  then  $f \circ g(x) =$

- A.  $x$                       B.  $2x$                       C.  $3x$                       D. 0

23. A cube of volume  $512 \text{ cm}^3$  is painted and is then cut into cubes with volume  $1 \text{ cm}^3$ .  
How many small cubes have no faces painted?

- A. 125                      B. 216                      C. 343                      D. 512

24. If  $\int 3e^2 dx$  equals

- A.  $3e^2 + c$                       B.  $e^3 + c$                       C.  $3e^2 x + c$                       D.  $x$

25. In how many ways can 6 students be split up into 2 equal teams?

- A. 10                      B. 12                      C. 15                      D. 20

26.  $\sec^{-1}(2) =$

- A.  $45^\circ$                       B.  $60^\circ$                       C.  $90^\circ$                       D.  $180^\circ$

27.  $\sin^{-1} x + \cos^{-1} x =$

- A.  $45^\circ$                       B.  $60^\circ$                       C.  $90^\circ$                       D.  $180^\circ$

28. What is the size of the acute angle between the hour and minute hands of a clock at 3:26?

- A.  $53^\circ$                       B.  $60^\circ$                       C.  $61^\circ$                       D.  $66^\circ$

29. The value of  $\lim_{x \rightarrow 0} \frac{\sin 2x}{x}$  is

A. 0

B. 1

C. 2

D. undefined

30. An object moves  $s$  metres in  $t$  seconds where  $s = 3 \sin 4t$ . The maximum velocity is

A. 3 m/s

B. 4 m/s

C. 7 m/s

D. 12 m/s