1. The domain of definition of $f(x) = log(x^2 - 2x - 3)$ is :
(a) $(0, \infty)$ (b) $(-\infty, -1)$ (c) $(-\infty, -1) \cup (3, \infty)$ (d) $(-\infty, -3) \cup (1, \infty)$.

2. ABC is a right-angled triangle with the right angle at B. If $\overline{AB} = 7, \overline{BC} = 24$, then the length of the perpendicular from B to AC is
(a) 12.2 (b) 6.72 (c) 7.2 (d) 3.36

3. If the points z_1 and z_2 are on the circles $|z| = 2, |z| = 3$ respectively and, the angle included between these vectors is 60^0, then $\frac{|z_1+z_2|}{|z_1-z_2|}$ equals
(a) $\sqrt{\frac{19}{7}}$ (b) $\sqrt{19}$ (c) $\sqrt{7}$ (d) $\sqrt{133}$.

4. Let a, b, c, d be positive integers such that $log_a(b) = 3/2$ and $log_c(d) = 5/4$. If $a - c = 9$, then $b - d$ equals
(a) 55 (b) 23 (c) 89 (d) 93.

5. $1 - x - e^{-x} > 0$ for :
(a) all $x \in \mathbf{R}$ (b) no $x \in \mathbf{R}$ (c) $x > 0$ (d) $x < 0$.

6. If $P(x) = ax^2 + bx + c$ and $Q(x) = -ax^2 + bx + c$, where $ac \neq 0$, then the equation $P(x)Q(x) = 0$ has :
(a) only real roots (b) no real roots (c) at least 2 real roots (d) exactly 2 real roots.

7. $lim_{x\to\infty}[\sqrt{x^2 + x} - x] =$
(a) $\frac{1}{2}$ (b) 0 (c) ∞ (d) 2.

8. $lim_{n\to\infty}\frac{\pi}{2^n}\sum_{j=1}^{2^n} sin(\frac{j\pi}{2^n}) =$
(a) 0 (b) π (c) 2 (d) 1.

9. Let $f : \mathbf{R} \to \mathbf{R}$ be given by $f(x) = x(x - 1)(x + 1)$. Then,
(a) f is 1-1 and onto (b) f is neither 1-1 nor onto (c) f is 1-1 but not onto (d) f is onto but not 1-1.

10. The last digit of 22^{22} is :
(a) 2 (b) 4 (c) 6 (d) 0.

11. The average of scores of 10 students in a test is 25. The lowest score is 20. Then, the highest score is at most
(a) 100 (b) 30 (c) 70 (d) 75

12. The coefficient of t^3 in the expansion of $(\frac{1-t^6}{1-t})^3$ is
(a) 10 (b) 12 (c) 8 (d) 9

13. Let $p_n(x), n \geq 0$ be polynomials defined by $p_0(x) = 1, p_1(x) = x$ and $p_n(x) = xp_{n-1}(x) - p_{n-2}(x)$ for $n \geq 2$. Then $p_{10}(0)$ equals
(a) 0 (b) 10 (c) 1 (d) -1

14. Suppose A, B are matrices satisfying $AB + BA = 0$. Then A^5B^2 is equal to
(a) 0 (b) B^2A^5 (c) $-B^2A^5$ (d) AB

15. The number of terms in the expansion of $(x + y + z + w)^{2009}$ is
(a) $\binom{2009}{4}$ (b) $\binom{2013}{4}$ (c) $\binom{2012}{3}$ (d) $(2010)^4$

16. If a, b, c are positive real numbers satisfying $ab + bc + ca = 12$, then the maximum value of abc is
(a) 8 (b) 9 (c) 6 (d) 12

17. If at least 90 per cent students in a class are good in sports, and at least 80 per cent are good in music and at least 70 per cent are good in studies, then the percentage of students who are good in all three is at least
(a) 25 (b) 40 (c) 20 (d) 50

18. If $cot(sin^{-1}\sqrt{13/17}) = sin(tan^{-1}\theta)$, then θ is
(a) $\frac{2}{\sqrt{17}}$ (b) $\sqrt{\frac{13}{17}}$ (c) $\sqrt{\frac{2}{\sqrt{13}}}$ (d) $\frac{2}{3}$.

19. Let $f(t) = \frac{t+1}{t-1}$. Then $f(f(2010))$ equals
(a) $\frac{2011}{2009}$ (b) 2010 (c) $\frac{2010}{2009}$ (d) none of the above.

20. If each side of a cube is increased by 60%, then the surface area of the cube increases by
(a) 156% (b) 160% (c) 120% (d) 240%

21. If $a > 2$, then
(a) $\log_e(a) + \log_a(10) < 0$ (b) $\log_e(a) + \log_a(10) > 0$ (c) $e^a < 1$ (d) none of the above is true.

22. The number of complex numbers w such that $|w| = 1$ and imaginary part of w^4 is 0, is
(a) 4 (b) 2 (c) 8 (d) infinite.

23. Let $f(x) = c.sin(x)$ for all $x \in \mathbf{R}$. Suppose $f(x) = \sum_{k=1}^{\infty} \frac{f(x+k\pi)}{2^k}$ for all $x \in \mathbf{R}$. Then
(a) $c = 1$ (b) $c = 0$ (c) $c < 0$ (d) $c = -1$

24. The number of points at which the function
$f(x) = max(1+x, 1-x)$ if $x < 0$ and
$f(x) = min(1+x, 1+x^2)$ if $x \geq 0$
is not differentiable, is
(a) 1 (b) 0 (c) 2 (d) none of the above

25. The greatest value of the function $f(x) = sin^2(x)cos(x)$ is
(a) $\frac{2}{3\sqrt{3}}$ (b) $\sqrt{\frac{2}{3}}$ (c) $\frac{2}{9}$ (d) $\frac{\sqrt{2}}{3\sqrt{3}}$

26. Let $g(t) = \int_{-10}^{t} (x^2+1)^{10} dx$ for all $t \geq -10$. Then
(a) g is not differentiable at $t = -10$ (b) g is constant (c) g is increasing in $(-10, \infty)$ (d) g is decreasing in $(-10, \infty)$

27. Let $p(x)$ be a continuous function which is positive for all x and $\int_2^3 p(x)dx = c\int_0^2 p(\frac{x+4}{2})dx$. Then
(a) $c = 4$ (b) $c = 1/2$ (c) $c = 1/4$ (d) $c = 2$

28. Let $f : [0,1] \to (1, \infty)$ be a continuous function. Let $g(x) = 1/x$ for $x > 0$. Then, the equation $f(x) = g(x)$ has
(a) no solutions (b) all points in $(0,1]$ as solutions (c) at least one solution (d) none of the above

29. Let $0 \leq \theta, \phi < 2\pi$ be two angles. Then, the equation $sin(\theta) + sin(\phi) = cos(\theta) + cos(\phi)$
(a) determines θ uniquely in terms of ϕ (b) gives two values of θ for each value of ϕ (c) gives more than two values of θ for each value of ϕ (d) none of the above

30. Ten players are to play in a tennis tournament. The number of pairings for the first round is
(a) $\frac{10!}{2^5 5!}$ (b) 2^{10} (c) $\binom{10}{2}$ (d) ${}^{10}P_2$