Sample Math Placement Test for Science Students

Duration: 60 minutes

1. Turn off your mobile phones.
2. Calculators are not allowed.

You have 20 multiple choice questions, each with 4 possible answers. Only one of the 4 possible answers is correct.

1. Suppose that $-7 \leq x \leq 9$ and $-6 \leq y \leq 5$, then the largest value of $(x - 4)^2 + (y - 3)^2$ is
   
   a) 200
   b) 101
   c) 202
   d) 136

2. The domain of definition of the function $f$ defined by $f(x) = \frac{1}{\sqrt{x^2 - 1}}$ is given by
   
   a) $x \leq -1$ or $x \geq 1$
   b) $x < -1$ or $x > 1$
   c) All real numbers
   d) $-1 < x < 1$

3. The derivative of the function $f$ defined by $f(x) = -\ln(x^2 + 1)$ is given by
   
   a) $\frac{2x}{x^2 + 1} \ln(x^2 + 1)$
   b) $\frac{-2x}{x^2 + 1}$
   c) $\frac{2x}{x^2 + 1}$
   d) $\frac{-2x}{x^2 + 1} \ln(x^2 + 1)$

4. The value of the integral $\int_{-\pi/2}^{\pi/2} (\cos x + \sin x + x) \, dx$ is
   
   a) 2
   b) $\frac{\pi^2}{4}$
   c) $\frac{\pi^2}{8}$
   d) 0
5. The derivative of \( \frac{\pi}{\sqrt{2\pi x+3}} \) is

a) \( \frac{-\pi}{(2\pi x+3)^\frac{1}{2}} \)

b) \( \frac{-\pi}{(2\pi x+3)^\frac{3}{2}} \)

c) \( \frac{-\pi^2}{(2\pi x+3)^\frac{1}{2}} \)

d) \( \frac{-\pi^2}{(2\pi x+3)^2} \)

6. The value of \( \lim_{x \to +\infty} \left[ x^4 \right] \) is

a) 2

b) \(+\infty\)

c) \( \frac{1}{2} \)

d) 0

7. Let A and B be two independent events such that P(A) = P(B) = 0.5. What is the value of P (A U B) ?

a) 0.55

b) 0.66

c) 0.85

d) 0.75

8. For which values of the real number \( p \), we have \( x^2 - 4x + p < 0 \) ?

a) \( p = 4 \)

b) \( p < 4 \)

c) \( p = 0 \)

d) \( p > 4 \)
9. Solutions of $|3x - 8| = 7$ are

   a) $x = 5$ or $\frac{1}{3}$
   b) $x = 5$
   c) $x = \frac{1}{3}$
   d) $x = 5$ and $x = \frac{1}{3}$

10. The area of the region shared by the graph of the function $f$ defined by $f(x) = 4 - x^2$ and the line $y = x - 2$, from $x = 0$ to $x = 2$ is given by

   a) $\frac{16}{3}$
   b) $\frac{22}{3}$
   c) 2
   d) $\frac{10}{6}$

11. Suppose that when the polynomial $p(x)$ is divided by $x - 5$, the quotient is $3x^4 - 5x^2 + 2x - 5$ with a remainder of 4. We can say that

   a) $x - 5$ is not a factor of $p(x)$ and 5 is not a zero of $p(x)$.
   b) $x + 5$ is not a factor of $p(x)$ and $-5$ is not a zero of $p(x)$.
   c) $x - 5$ is a factor of $p(x)$ and 5 is a zero of $p(x)$.
   d) $x - 4$ is a factor of $p(x)$ and 4 is not a zero of $p(x)$.

12. The inverse function $f^{-1}$ of the function $f$ defined by $f(x) = \sqrt{x - 3}$ for $x > 3$ is given by

   a) $f^{-1}(x) = \frac{1}{\sqrt{x-3}}$
   b) $f^{-1}(x) = \sqrt{x + 3}$
   c) $f^{-1}(x) = 3 - x^2$
   d) $f^{-1}(x) = 3 + x^2$

13. If $\sin t = \frac{1}{5}$ and $0 < t < \frac{\pi}{2}$, then $\sin(2t) + \cos(t - \pi) + \sin(t + \frac{\pi}{2}) =

   a) $-\frac{8\sqrt{24}}{25}$
   b) $\frac{8\sqrt{24}}{25}$
   c) $\frac{2\sqrt{24}}{25}$
   d) $-\frac{2\sqrt{24}}{25}$
14. What can you say about the graph of $y = 3x^4 - \frac{2}{x^2}$?

a) It is symmetric about the $y$-axis.
b) It is symmetric with respect to the origin
c) It is symmetric about the $x$-axis
d) It has no symmetries

15. A line passing through the point $(-2, 11)$ intercepts the $y$-axis at the point $(0, 5)$. The line also passes through the point $(a, -22)$. The value of $a$ is

a) 13
b) $-13$
c) $-9$
d) 9

16. Which of the following is an equation of a circle in the $xy$-plane with center $(0, 4)$ and a radius with endpoint $\left(\frac{4}{3}, 5\right)$?

a) $x^2 + (y - 4)^2 = \frac{25}{9}$
b) $x^2 + (y + 4)^2 = \frac{25}{9}$
c) $x^2 + (y - 4)^2 = \frac{5}{3}$
d) $x^2 + (y + 4)^2 = \frac{5}{3}$

17. The set of all points that are equidistant from the points $(1, 1)$ and $(1, -3)$ is

a) $y = -1$
b) $y = 1$
c) $x = -1$
d) $x = 1$

18. Consider two functions $f$ and $g$ defined by $f(x) = x^2 + x$ and $g(x) = \frac{2}{x}$.

a) $f(f(x)) = x^4 + 2x^3 + 2x^2 + x$
b) $f(f(x)) = x^4 + 2x^3 + 2x$
c) $g(g(x)) = \frac{1}{x}$
d) $g(g(x)) = \frac{1}{x^2}$
19. In the figure below, $ABCF$ is a square and the two triangles $EFD$ and $\Delta FCD$ are equilateral. What is the measure of the angle $AEF$?

![Diagram of a square with triangles](image)

- a) $15^\circ$
- b) $25^\circ$
- c) $30^\circ$
- d) $35^\circ$

20. Consider the following 2 vectors $\overrightarrow{AB} = 2i - j$ and $\overrightarrow{AC} = wi - 5j$. We assume that the point $C$ lies on the segment $[AB]$. The value of $w$ is

- a) $-10$
- b) $\frac{-5}{2}$
- c) $\frac{-5}{2}$
- d) $10$