# Sample Math Placement Test for Science Students

# Duration: 60 minutes

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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 $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} (\cos x + \sin x + x)dx$ 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)** $\frac{-\pi^2}{(2\pi x+3)^{\frac{3}{2}}}$

6. The value of $\lim_{x \to +\infty} \left[\frac{x^4}{2x^4+1}\right]$ 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)** $\boldsymbol{p > 4}$

9. Solutions of $|3x - 8| = 7$ are

a) $\boldsymbol{x = 5 \text{ or } \frac{1}{3}}$
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)** $\boldsymbol{x^2 + (y-4)^2 = \frac{25}{9}}$
b) $x^2 + (y+4)^2 = \frac{25}{9}$
c) $x^2 + (y-4)^2 = \frac{5}{3}$
d) $x^2 + (y+4)^2 = \frac{5}{3}$

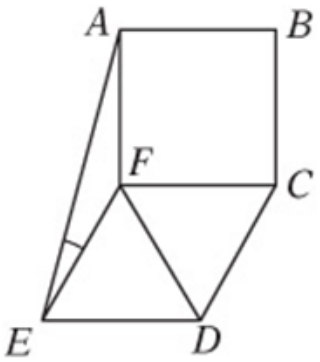
17. The set of all points that are equidistant from the points $(1, 1)$ and $(1, -3)$ is

**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 Δ*FCD* are equilateral. What is the measure of the angle *AEF*?




**a) 15°**
b) 25°
c) 30°
d) 35°

20. Consider the following 2 vectors $\overrightarrow{AB} = 2\boldsymbol{i} - \boldsymbol{j}$ and $\overrightarrow{AC} = w\boldsymbol{i} - 5\boldsymbol{j}$. 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**