Name: ________________________________

Signature: ________________________________

Select one answer for each of the following twenty problems. **Five points** for each correct answer. **Negative one point** for each incorrect answer. **One point** for each problem left blank. No calculators or cellular phones allowed.

1. If the points \((1, y_1)\) and \((-1, y_2)\) lie on the graph of \(y = ax^2 + bx + c\), and \(y_1 - y_2 = -6\), then \(b\) equals
   (a) \(-3\)
   (b) 0
   (c) 3
   (d) \(\sqrt{ac}\)
   (e) \(\frac{a + c}{2}\)

   **Answer a**

2. The equation \(2^{2x} - 8 \cdot 2^x + 12 = 0\) is satisfied by:
   (a) \(\log 3\)
   (b) \(\frac{1}{2} \log 6\)
   (c) \(1 + \log \left(\frac{3}{2}\right)\)
   (d) \(1 + \frac{\log 3}{\log 2}\)
   (e) \(\frac{\log 2}{\log 3}\)

   **Answer d**
3. The fourth power of $\sqrt{1 + \sqrt{1 + \sqrt{1}}}$ is

(a) $\sqrt{2} + \sqrt{3}$

(b) $\frac{7 + 3\sqrt{5}}{2}$

(c) $1 + 2\sqrt{3}$

(d) 3

(e) $3 + 2\sqrt{2}$

4. A square and a circle have equal perimeters. The ratio of the area of the circle to the area of the square is

(a) $\frac{4}{\pi}$

(b) $\frac{\pi}{\sqrt{2}}$

(c) $\frac{4}{1}$

(d) $\frac{\sqrt{2}}{\pi}$

(e) $\frac{\pi}{4}$

Answer a

5. If $f(x) = \frac{x^4 + x^2}{x + 1}$, then $f(i)$, where $i = \sqrt{-1}$, is equal to

(a) $i + 1$

(b) 1

(c) $-1$

(d) 0

(e) $-1 - i$

Answer d
6. If \( a = \log_8 225 \) and \( b = \log_2 15 \), then

(a) \( a = \frac{b}{2} \)

(b) \( a = \frac{2b}{3} \)

(c) \( a = b \)

(d) \( b = \frac{a}{2} \)

(e) \( a = \frac{3b}{2} \)

7. If the point \((x, -4)\) lies on the straight line joining the points \((0, 8)\) and \((-4, 0)\), then \(x\) is equal to

(a) \(-2\)

(b) 2

(c) \(-8\)

(d) 6

(e) \(-6\)

8. If the line \(y = mx + 1\) intersects the ellipse \(x^2 + 4y^2 = 1\) exactly once, then \(m^2\) is

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

(b) \(\frac{2}{3}\)

(c) \(\frac{3}{4}\)

(d) \(\frac{4}{5}\)

(e) \(\frac{5}{6}\)
9. The sum of the squares of the roots of \( x^2 + 2hx = 3 \) is 10. The absolute value of \( h \) is

(a) 1

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

(c) \( \frac{3}{2} \)

(d) 2

(e) none of these

Answer a

10. The area of a sector of a circle with radius 5 cm is 10 cm\(^2\). The central angle, measured in radians, is

(a) \( \frac{\pi}{2} \)

(b) 1

(c) \( \frac{\pi}{3} \)

(d) \( \frac{4}{5} \)

(e) none of these

Answer d

11. If \( 0 < \alpha < \frac{\pi}{2} \), and \( \sin \alpha + 1 = 2\sqrt{1 - \sin^2 \alpha} \), then \( \sin \alpha \) is

(a) \( \frac{4}{5} \)

(b) 1

(c) \(-1\)

(d) \( \frac{3}{5} \)

(e) 0

Answer d
12. If one root of \(x^3 - 5x^2 + 5x - 1 = 0\) is \(2 - \sqrt{3}\), then the sum of the other two roots is

(a) \(-7 + \sqrt{3}\)

(b) \(-1 + \sqrt{3}\)

(c) \(3 + \sqrt{3}\)

(d) \(-3 + \sqrt{3}\)

(e) 5

13. If \(2^{x+1} + 2^x = 3^{y+2} - 3^y\), where \(x\) and \(y\) are integers, then the value of \(x\) is

(a) 0

(b) 3

(c) \(-1\)

(d) 1

(e) 2

14. The value of \(\lim_{\theta \to 0} \frac{\sin^2 \theta \cot \theta}{\theta}\)

(a) \(\pi\)

(b) 1

(c) 0

(d) undefined

(e) \(-1\)
15. What is the slope of the tangent line to $y = x \sin x$ at $x = \pi$.

   (a) $-\pi$

   (b) $\pi$

   (c) 0

   (d) 1

   (e) $-1$

16. $\cot (10) + \tan (5)$ is

   (a) $\csc (5)$

   (b) $\csc (10)$

   (c) $\sec (5)$

   (d) $\sec (10)$

   (e) $\sin (15)$

17. Find the sum of the roots of $\tan^2 x - 9 \tan x + 1 = 0$ that are between $x = 0$ and $x = 2\pi$ radians.

   (a) $\frac{\pi}{2}$

   (b) $\pi$

   (c) $\frac{3\pi}{2}$

   (d) $3\pi$

   (e) $4\pi$
18. The consecutive angles of a trapezoid form an arithmetic sequence. If the smallest angle is 75°, then the largest angle is

(a) 95°

(b) 100°

(c) 105°

(d) 110°

(e) 115°

Answer c

19. If \( f(x) = ax^2 - \sqrt{2} \), for all \( a > 0 \) and \( f(f(\sqrt{2})) = -\sqrt{2} \), then \( a \) is

(a) \( \frac{2 - \sqrt{3}}{2} \)

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

(c) \( 2 - \sqrt{2} \)

(d) \( \frac{\sqrt{2}}{2} \)

(e) \( \frac{2 + \sqrt{2}}{2} \)

Answer d

20. If \( x, y > 0 \), \( \log_y x + \log_x y = \frac{10}{3} \) and \( xy = 144 \), then \( \frac{x + y}{2} \) is

(a) \( 12\sqrt{2} \)

(b) \( 13\sqrt{3} \)

(c) 24

(d) 30

(e) 36

Answer b