Part 1: Multiple Choice. **Calculator allowed**. Penalty for incorrect answers.

1. $\lim_{x\to 0} \frac{\sin 4x}{2x} =$

a. 2 b. 1 c. 0 d. 1/2 e. does not exist

2. If the derivative of a function f is given by $f'(x) = \sin(x^x)$, then how many ***critical*** points does the function f(x) have on the interval [0.2,2.6]?

a. 0 b. 1 c. 2 d. 3 e. 4

3. If the function f is continuous for all real numbers and if $f(x) = \frac{x^2-4}{x+2}$ when $x \neq -2$, then $f(-2) =$

a. –4 b. –2 c. –1 d. 0 e. 2

4. Which of the following is an equation of the line tangent to the graph of $f(x) = x^4 + 2x^2$ at the point where $f'(x) = 1$?

a. $y = 8x - 5$ b. $y = x + 7$ c. $y = x + 0.763$

d. $y = x - 0.122$ e. $y = x - 2.146$

5. The tangent line to the graph of y = sin x at the point $(\frac{2\pi}{3}, \frac{\sqrt{3}}{2})$ crosses the sine graph at the point where x =

a. –0.781 b. 4.712 c. 5.388 d. 5.760 e. 6.283

6. A particle moves along a line so that at time t, where $0 \le t \le \pi$, its position is given by $s(t) = -4\cos t - \frac{t^2}{2} + 10$. What is the velocity of the particle **when its acceleration is zero**?

a. –5.19 b. 0.74 c. 1.32 d. 2.55 e 8.13

9. The volume of a cylindrical tin can with a top and a bottom is to be 16π cubic inches. If a minimum amount of tin is to be used to construct the can, what must be the height, in inches, of the can? (Note: $V = \pi r^2 h,\ S.A. = 2\pi r^2 + 2\pi rh$)

a. 2.520 b. 2.828 c. 3.175 d. 4 e. 8

Multiple Choice Part 2: **No calculator allowed**. Penalty for incorrect answers.

10. The function f given by $f(x) = x^3 - 6x^2 - 15x - 2$ is

    a. decreasing for $x < -1$, increasing for $-1 < x < 5$, decreasing for $x > 5$

    b. decreasing for $x < -1$, increasing for $x > -1$

    c. increasing for all x

    d decreasing for all x

    e. increasing for $x < -1$, decreasing for $-1 < x < 5$, increasing for $x > 5$

11. If $f(x) = (x^2 + 2x - 1)^{2/3}$, then $f'(0) =$

    a. 4/3 b. 0 c. – 2/3 d. –4/3 e. –2

12. An equation of the line **normal** to the graph of $3x^2 + 2xy + y^3 = 2$ at the point (–1, 1) is

    a. $x + 4y = 3$ b. $-x + 4y = 5$ c. $4x + y = 3$

    d. $4x - y = -5$ e. $4x - y = -3$

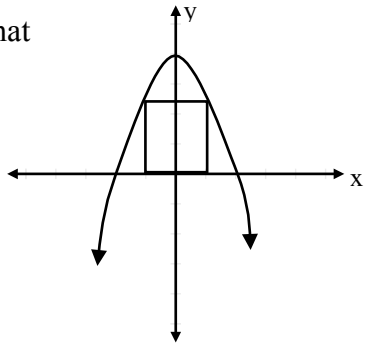
13. If the graph of $y = \dfrac{ax + b}{x + c}$ has a horizontal asymptote y = 4 and a vertical asymptote $x = -2$, then $a + c =$

    a –6 b. –2 c. 0 d. 2 e. 6

14. $\lim\limits_{h \to 0} \dfrac{\sin(\frac{\pi}{2} + h) - \sin(\frac{\pi}{2})}{h} =$

    a. –1 b. 0 c. 1 d. $\frac{1}{2}$ e. does not exist

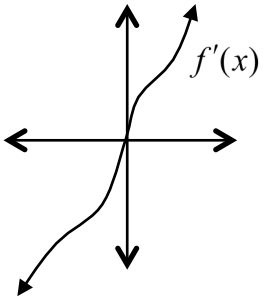
15. A rectangle is placed such that it has two vertices on the x-axis, and two on the curve $y = 4 - x^2$ (as shown). Determine the value of x that would create the rectangle of maximum area.



a. $\frac{4}{3}$ b. 2 c. $\sqrt{3}$

d. $\frac{2\sqrt{3}}{3}$ e. $2\sqrt{3}$

16. Given the graph of $f'(x)$ shown, which of the following statements **must** be true?



I. $f'(x)$ is increasing for all x
II. $f''(x) > 0$ for all x
III. $f(x)$ is increasing when $x > 0$ and decreasing when $x < 0$

a. I only b. I and II only c. III only

d. all are true e. none are true

17. The 27^{th} derivative of $f(x) = \cos x$ is

a. sin x b. cos x c. –sin x d. –cos x e. 0

18. The surface area of a cube is increasing at the rate of 10 square centimeters per second. How fast, in cubic centimeters per second, is the volume of the cube increasing at the instant when each edge of the cube is 10 centimeters long?

a. 2.5 b. 10 c. 15 d. 25 e. 150