1) Find ONE of the integrals below. (6 points)

\[ \int 2x(x^2 - 1)^9dx \]

\[ \int_0^1 2x(4 - x^2)dx \]

2) Find the integral below. (6 points)

\[ \int \frac{2x^2}{\sqrt{1 - 4x^3}} \, dx \]
3) Find the integral below. (6 points)

\[ \int \frac{x}{\sqrt{x - 4}} \, dx \]

4) Find ONE of the integrals below. (6 points)

\[ \int_{\ln(4)}^{\infty} \frac{e^x}{3 + 2e^x} \, dx \]

\[ \int_{0}^{\frac{\pi}{2}} \sin^2(\theta) \cos(\theta) \, d\theta \]
5) Consider the function \( f(x) = x^2 \) on the interval \([1,4]\). The mean value theorem guarantees that there is a point \( x = c \) such that \( f'(c) = m \). In this context, what is \( m \)?

(4 points)

6) Consider the function \( f \) with derivative \( f'(x) = 3x^2 + 3 \) and initial value \( f(1) = 8 \). Find \( f(x) \).

(6 points)
7) Use geometry to find the **actual** area between \( f(x) \) and the \( x \)-axis between \( x = 0 \) and \( x = 6 \). (6 points)

8) Use a **right** Riemann Sum with 3 rectangles to **estimate** the area between \( f(x) \) and the \( x \)-axis between \( x = 0 \) and \( x = 6 \). (Illustrate your rectangles and find the area) (6 points)
9) Below is a graph of a function with some associated areas. Use the graph to find the integral below.

(6 points)

\[ \int_{0}^{8} f(x) \, dx \]
10) A velocity function is given below. Find the displacement over the interval $0 \leq t \leq 8$

$v(t) = t^2 - 6t + 8$

(Set up, but do not integrate.)

(6 points)

11) A velocity function is given below. Find the distance travelled over the interval $0 \leq t \leq 8$

$v(t) = t^2 - 6t + 8$

(Set up, but do not integrate.)

(6 points)
On problems 12-17 illustrate the problem using a Cartesian Plane, then find the solution.

12) Find the area of the region bounded by $y = 2 - |x|$ and $y = x^2$.
(Set up, but do not integrate.)
(6 points)

13) The region bounded by $y = \sqrt{25 - x^2}$ and $y = 0$ is rotated around the $x$-axis. Find the volume of the resulting 3-D solid. (Set up, but do not integrate. Circle which method you’re using)
(Disk/washer) (Cylindrical Shell)
(6 points)
14) The region bounded by \( y = x \) and \( y = \sqrt{x} \) is rotated around the \( x \)-axis. Find the volume of the resulting 3-D solid. (Set up, but do not integrate. Circle which method you’re using)
(Disk/washer)  (Cylindrical Shell)
(6 points)

15) The region bounded by \( y = x^3 - x^8 + 1 \) and \( y = 1 \) is rotated around the \( x \)-axis. Find the volume of the resulting 3-D solid. (Set up, but do not integrate. Circle which method you’re using)
(Disk/washer)  (Cylindrical Shell)
16) Find the length of the curve \( y = x^3 + 2 \) between \( x = -2 \) and \( x = 1 \).
(Set up, but do not integrate.)
(6 points)

17) Find the area of the surface generated when the curve \( y = 8\sqrt{x} \) between \( x = 9 \) and \( x = 20 \) is rotated around the \( x \)-axis.
(Set up, but do not integrate.)
(6 points)