

This truly spine tingling fifty-minute, 4-page test “covers” chapter six of *Calculus ET* (6ed) by Stewart.

Clearly indicate your answers. Each part of each problem is worth five points. Pay attention to whether or not you need to evaluate the integrals.

1. Find the area between the curves: $y = x^2$, $x = y^2$.
 - a. First, set up the integral (do not evaluate yet).

 - b. Now integrate to find the exact answer.

2. Find the area between the curves: $y = x^2$, $y = x^4$, $x = 0$, $x = 1$.
 - a. First, set up the integral (do not evaluate yet).

 - b. Now integrate to find the exact answer.

3. How much work is required to lift a 100-kg sandbag to a height of 3 m?
($g = 9.8 \text{ m/sec}^2$, $1 \text{ J} = 1 \text{ kg m}^2/\text{sec}^2 = 1 \text{ N m}$.)

4. Find the volume of the solid obtained by rotating the region bounded by $y = 2x + 4$, $y = 6$ and $x = 0$, about the y -axis.
- Set up the integral using the disk/washer method.
 - Set up the integral using the cylindrical shell method.
 - Evaluate one of the two integrals above.
5. Find the volume of the solid obtained by rotating the region bounded by $y = 2x + 4$, $y = 6$ and $x = 0$, about the $y = 4$.
- Set up the integral using the disk/washer method.
 - Set up the integral using the cylindrical shell method.
 - Evaluate one of the two integrals above.

6. A spring has a natural length of 3 m. A 200-N force is required to stretch it from its natural length to a length of 7 m.
- Find the spring constant k .
 - Find exactly how much work is required to stretch the spring from 5 to 10 m.
7. A circular swimming pool has a diameter of 24 ft, the sides are 4 ft high, but the water depth is only 3 ft. Water weighs 62.5 lbs/ft.
- Set up the integral to determine the work required to pump all of the water out
 - Evaluate this integral.

8. Average values.

a. Set up the integral to find the average value of $y = \cos^4 x \sin x$ on the interval $[0, \pi]$.

b. The function that defines the shape of the standard normal curve (e.g., “bell-shaped curve”) is

$f(x) = \frac{1}{\sqrt{2\pi}} e^{-x^2/2}$. Set up the integral to find the average of $f(x)$ on $[-1, 1]$.

c. Evaluate one of the two integrals above.