

# Test 2

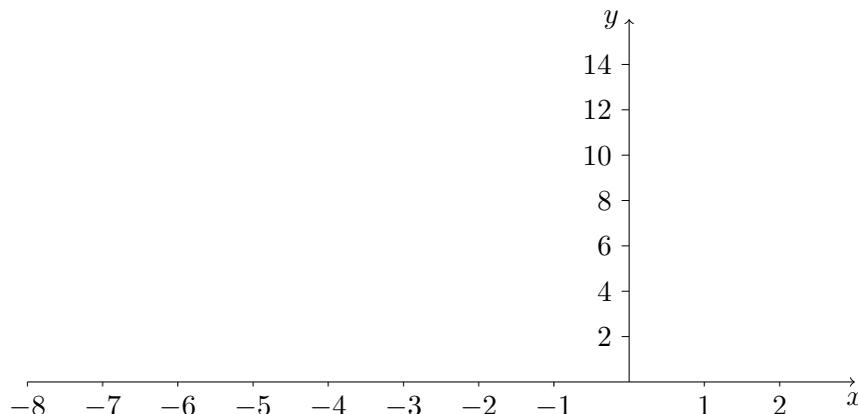
Show all your work

Name: \_\_\_\_\_

Score: \_\_\_\_/33

**No Calculator permitted** in this part. Read the questions carefully. Show all your work and clearly indicate your final answer. Use proper notation.

**Problem 1:** First draw  $y = x^2 + 4$  and  $y = 10$ . Shade the region in the first quadrant bounded by these two graphs and the  $y$ -axis.



Use integrals to express the following. **DO NOT EVALUATE YOUR INTEGRALS.** Draw a cross-sectional strip for each solid of rotation.

- a. The area of the shaded region.

Score: /2

- b. The volume obtained if the region is rotated about  $x = -3$ , using the method of slicing (washers/disks).

Score: /2

- c. The volume obtained if the region is rotated about  $y = 12$ , using the method of cylindrical shells.

Score: /2

- d. The volume of a solid that has the shaded region as its base, and cross-sections perpendicular to the  $x$ -axis are squares.

Score: /2

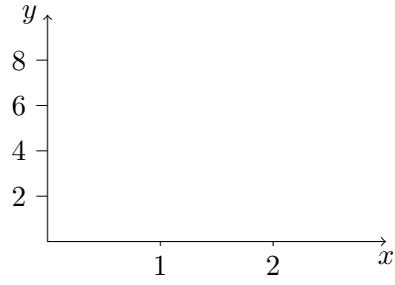
- e. The volume of a solid with the shaded region as its base, and cross-sections perpendicular to the  $y$ -axis are equilateral triangles.

Score: /2

**Problem 2:** First, draw the following graphs on the coordinate system, then shade the region bounded by them:

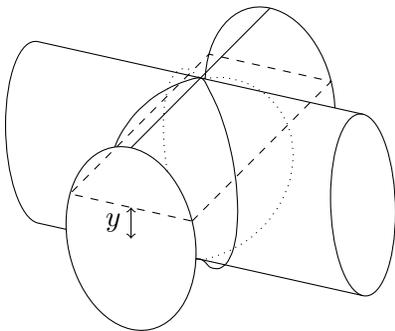
$$f(x) = \frac{8}{x^2}, \quad g(x) = 8x, \quad \text{and} \quad h(x) = x.$$

Set up the integral for the area of the shaded region, then evaluate the integral.



Score: /4

**Problem 3:** The solid  $S$  is the intersection of two cylinders of radius  $r$  whose axes are perpendicular. Find the volume of  $S$  as a function of  $r$ .



Score: /4

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Show all your work

Name: \_\_\_\_\_

Calculators permitted from here on.

**Problem 4:** The acceleration of a Nerf bullet is  $a(t) = 60t - 4t^3$  meters per second squared after it is fired. Compute the average acceleration and the average velocity over the time interval  $[2, 6]$ , assuming that the particle's initial velocity is zero (that is,  $v(0) = 0$ ).

Score: /4

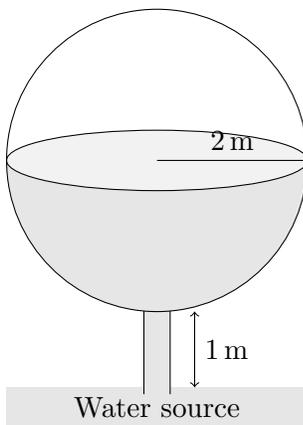
**Problem 5:** If 5 J of work are needed to stretch a spring 10 cm beyond equilibrium, how much work is required to stretch it 15 cm beyond equilibrium?

Score: /4

**Problem 6:** Calculate the work required to lift a 10 m chain over the side of a building. Assume that the chain has a density of 8 kg/m.

Score: /3

**Problem 7:** Water is pumped into a spherical tank of radius 2 m from a source located 1 m below a hole at the bottom. The density of water is  $1000 \text{ kg/m}^3$ . Calculate the work  $F(h)$  required to fill the tank to level  $h$  metres in the sphere.



Score: /4