MATH 16020: Applied Calculus 2 Practice Exam 2 Wed., Mar. 1, 2023

Please show **all** your work! Answers without supporting work will not be given credit. Write answers in spaces provided.

Name:_____

1. Determine if the following integral is proper or improper.

$$\int_0^{\pi/2} \frac{\sin x}{1-\cos x}\, dx$$

(A) It is improper because of a discontinuity at $x = \pi/6$
(B) It is improper because of a discontinuity at $x = \pi/4$
(C) It is improper because of a discontinuity at $x = \pi/3$
(D) It is improper because of a discontinuity at $x = 0$
(E) It is improper because of a discontinuity at $x = \pi/2$
(F) It is proper since it is defined on the interval $[0, \pi/2]$.

2. Determine if the following integral is proper or improper.

$$\int_0^{\pi/2} \tan(x)\, dx$$

(A) It is improper because of a discontinuity at $x = \pi/6$
(B) It is improper because of a discontinuity at $x = \pi/4$
(C) It is improper because of a discontinuity at $x = \pi/3$
(D) It is improper because of a discontinuity at $x = 0$
(E) It is improper because of a discontinuity at $x = \pi/2$
(F) It is proper since it is defined on the interval $[0, \pi/2]$.

3. Evaluate the following integral;

$$\int_0^{\infty} e^{-3x} dx$$

$$\int_0^{\infty} e^{-3x} dx \;=\; \_\_\_\_\_$$

4. Evaluate the following integral;

$$\int_1^\infty \frac{5}{\sqrt{x}} dx$$

$$\int_1^\infty \frac{5}{\sqrt{x}} dx \quad = \quad \underline{\qquad\qquad\qquad\qquad}$$

5. Evaluate the following integral;

$$\int_1^\infty \frac{3}{x^2} dx$$

$$\int_1^\infty \frac{3}{x^2} dx \quad = \quad \underline{\qquad\qquad\qquad\qquad}$$

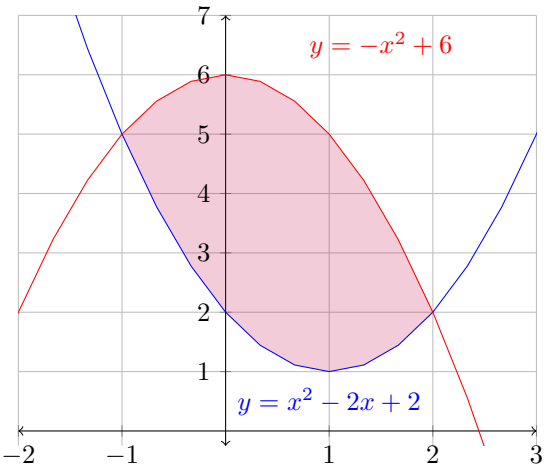
6. Evaluate the following integral;

$$\int_1^\infty \frac{10}{x} dx$$

$$\int_1^\infty \frac{10}{x} dx \quad = \quad \underline{\qquad\qquad\qquad\qquad}$$

7. Set up the integral that computes the **AREA** shown to the right with respect to x.

DON'T COMPUTE IT!!!



Area = _____

8. Set up the integral that computes the **AREA** shown to the right with respect to y.

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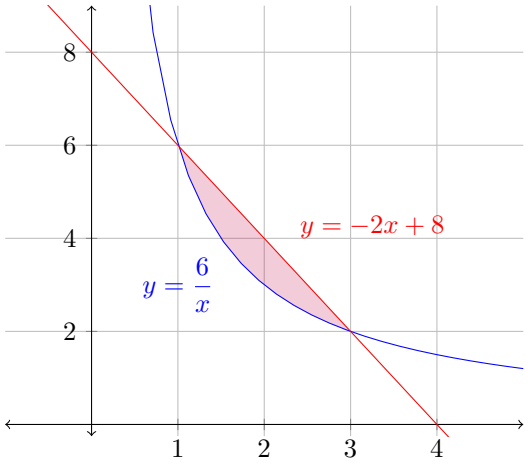


Area = _____

9. Set up the integral that computes the **AREA** with respect to x of the region bounded by

$$y = \frac{2}{x} \quad \text{and} \quad y = -x + 3$$

Area = _____

10. Calculate the **AREA** of the region bounded by the following curves.

$$x = 100 - y^2 \quad \text{and} \quad x = 2y^2 - 8$$

Area = _____

11. Calculate the **AREA** of the region bounded by the following curves.

$$y = x^3 \quad \text{and} \quad y = x^2$$

Area = _____

12. After t hours studying, one student is working $Q_1(t) = 25 + 9t - t^2$ problems per hour, and a second student is working on $Q_2(t) = 5 - t + t^2$ problems per hour. How many more problems will the first student have done than the second student after 10 hours?

Answer:_____

13. Set up the integral that computes the **VOLUME** of the region bounded by

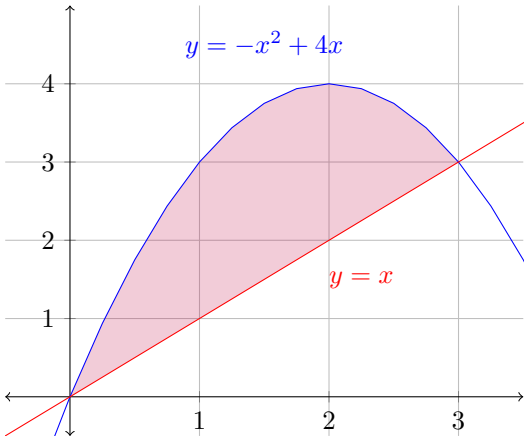
$$y = x + 8, \quad \text{and} \quad y = (x - 4)^2$$

about the x-axis

Volume = _____

14. Let R be the region shown below. Set up the integral that computes the **VOLUME** as R is rotated around the x-axis.

DON'T COMPUTE IT!!!



Volume = _____

15. Set up the integral that computes the **VOLUME** of the region bounded by

$$y = \sqrt{16 - x}, \quad y = 0 \quad \text{and} \quad x = 0$$

about the y-axis

Volume = _____

16. Find the **VOLUME** of the region bounded by

$$y = 7x, \quad y = 0 \quad x = 1 \quad \text{and} \quad x = 3$$

around the x-axis

Volume = _____

17. Set up the integral that computes the **VOLUME** of the region bounded by

$$y = x^2, \quad \text{and} \quad y = \sqrt{x}$$

about the y-axis

Volume = _____

18. Find the **VOLUME** of the region bounded by

$$y = x - x^2, \quad \text{and} \quad y = 0$$

around the x-axis

Volume = _____

19. Find the **VOLUME** of the region bounded by

$$y = 10x, \quad x = 0, \quad y = 10$$

around the y-axis

Volume = _____

20. Find the **VOLUME** of the region bounded by

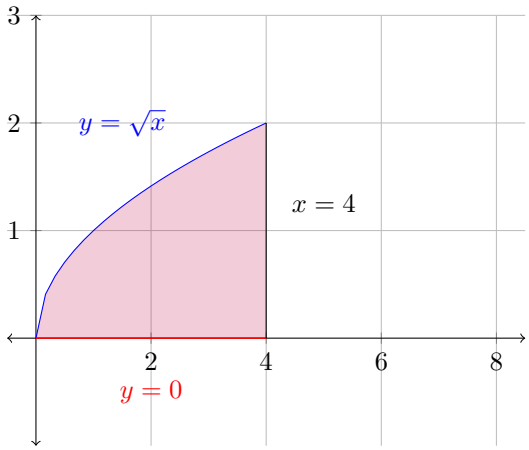
$$x + 3y = 9, \quad x = 0, \quad y = 0$$

around the y-axis

Volume = _____

21. Let R be the region shown to the right. Set up the integral that computes the **VOLUME** as R is rotated around the line $x = 4$.

DON'T COMPUTE IT!!!



Volume = _____

22. Set up the integral needed to find the volume of the solid obtained when the region bounded by

$$y = 2 - x^2 \quad \text{and} \quad y = x^2$$

is rotated about the line $y = 3$.

Volume = _____

23. Find the **VOLUME** of the region bounded by

$$y = 3x^2, \quad x = 0, \quad y = 27$$

around the line $y = 27$

Volume = _____

24. Find the general solution to the differential equation:

$$\frac{dy}{dx} = \frac{3x^2}{y}$$

y = _____

25. Find the general solution to the differential equation:

$$\frac{dy}{dx} = 5y$$

y = _____

26. Find the general solution to the differential equation:

$$\frac{dy}{dx} = \frac{-x}{y}$$

y = _____

27. Let y denote the mass of a radioactive substance at time t. Suppose this substance obeys the equation

$$y' = -18y$$

Assume that initially, the mass of the substance is $y(0) = 20$ grams. At what time t in hours does half the original mass remain? Round your answer to 3 decimal places.

t = _____