MATH 16020 PRACTICE EXAM 2 WED., MARCH 6, 2024

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

Name:_____

1. Evaluate the definite integral.

$$\int_0^{\pi/2} (x-1)\sin(x)\,dx$$

$$\int_0^{\pi/2} (x-1)\sin(x)\,dx = \_\_\_\_\_$$

2. Evaluate

$$\int 3x\ln(x^7)\,dx$$

$$\int 3x\ln(x^7)\,dx = \_\_\_\_\_$$

3. Evaluate

$$\int x^3 \ln(2x)\, dx$$

$$\int x^3 \ln(2x)\, dx = \_\_\_\_\_$$

4. Evaluate the definite integral.

$$\int_0^3 5xe^{3x}\, dx$$

$$\int_0^3 5xe^{3x}\, dx = \_\_\_\_\_$$

5. Evaluate the indefinite integral.

$$\int_0^{\pi/4} 5x \sin(2x)\, dx$$

$$\int_0^{\pi/4} 5x \sin(2x)\, dx = \_\_\_\_\_$$

6. Evaluate the indefinite integral.

$$\int 4t\sqrt{2t+5}\, dt$$

$$\int 4t\sqrt{2t+5}\, dt = \_\_\_\_\_$$

7. The velocity of a cyclist during an hour-long race is given by the function

$$v(t) = 166te^{-2.2t} \text{ mi/hr}, \qquad 0 \leq t \leq 1$$

Assuming the cyclist starts from rest, what is the distance in miles he traveled during the first hour of the race?

Answer:_____

8. After t days, the growth of a plant is measured by the function $2000te^{-20t}$ inches per day. What is the change in the height of the plant (in inches) after the first 14 days?

Answer: _____

9. A model for the ability of a child to memorize information, measured on a scale from 1 to 100, is given by

$$M(t) = 1.9t \ln(t),$$

$2 \leq t \leq 8$, where t is the child's age in years. Find the child's average memorization ability between ages 2 and 7 years. Round to threee decimal places.

Answer:_____

10. Which of the following is a partial fraction decomposition of the rational expression show? Do not explicitly solve for the constant.

$$f(x) = \frac{3x+1}{x^2(x+1)^2(x^2+1)}$$

(A) $\dfrac{A}{x^2} + \dfrac{B}{(x+1)^2} + \dfrac{C}{x^2+1}$

(B) $\dfrac{A}{x} + \dfrac{B}{x^2} + \dfrac{C}{x+1} + \dfrac{D}{(x+1)^2} + \dfrac{E}{x^2+1}$

(C) $\dfrac{A}{x} + \dfrac{B}{x^2} + \dfrac{C}{x+1} + \dfrac{D}{(x+1)^2} + \dfrac{Ex+F}{x^2+1}$

(D) $\dfrac{A}{x} + \dfrac{Bx+C}{x^2} + \dfrac{D}{x+1} + \dfrac{Ex+F}{(x+1)^2} + \dfrac{Gx+H}{x^2+1}$

(E) $\dfrac{A}{x} + \dfrac{B}{(x+1)^2} + \dfrac{C}{x^2+1}$

11. Which of the following is a partial fraction decomposition of the rational expression show? Do not explicitly solve for the constant.

$$f(x) = \frac{7x-5}{x^2(x^2+9)}$$

(A) $\dfrac{A}{x} + \dfrac{B}{x} + \dfrac{Cx+D}{x^2+9}$

(B) $\dfrac{A}{x} + \dfrac{B}{x^2} + \dfrac{Cx+D}{x^2+9}$

(C) $\dfrac{A}{x} + \dfrac{Bx+C}{x^2} + \dfrac{Dx+E}{x^2+9}$

(D) $\dfrac{Ax+B}{x^2} + \dfrac{Cx+D}{x^2+9}$

(E) $\dfrac{A}{x} + \dfrac{B}{x^2} + \dfrac{C}{x+3} + \dfrac{D}{x-3}$

(F) $\dfrac{Ax+B}{x^2} + \dfrac{C}{x+3} + \dfrac{D}{x-3}$

12. Which of the following is a partial fraction decomposition of the rational expression show? Do not explicitly solve for the constant.

$$f(x) = \frac{x^2 + 2x + 3}{(x-1)^2(x-2)(x^2+4)}$$

(A) $\dfrac{A}{x-1} + \dfrac{B}{(x-1)^2} + \dfrac{C}{x-2} + \dfrac{Dx+E}{x^2+4}$

(B) $\dfrac{A}{x-1} + \dfrac{B}{(x-1)^2} + \dfrac{C}{x-2} + \dfrac{D}{x^2+4}$

(C) $\dfrac{A}{x-1} + \dfrac{Bx+C}{(x-1)^2} + \dfrac{D}{x-2} + \dfrac{E}{x^2+4}$

(D) $\dfrac{A}{x-1} + \dfrac{B}{(x-1)^2} + \dfrac{C}{x-2} + \dfrac{Dx}{x^2+4}$

(E) $\dfrac{A}{x-1} + \dfrac{Bx}{(x-1)^2} + \dfrac{C}{x-2} + \dfrac{Dx+E}{x^2+4}$

13. Which of the following is a partial fraction decomposition of the rational expression show? Do not explicitly solve for the constant.

$$f(x) = \frac{24}{(x^2-16)^2}$$

(A) $\dfrac{A}{x-4} + \dfrac{Bx+C}{(x-4)^2} + \dfrac{D}{x+4} + \dfrac{Ex+F}{(x+4)^2}$

(B) $\dfrac{A}{x+2} + \dfrac{B}{(x+2)^2} + \dfrac{C}{x-2} + \dfrac{D}{(x-2)^2} + \dfrac{E}{x+4} + \dfrac{F}{(x+4)^2}$

(C) $\dfrac{Ax+B}{(x-4)^2} + \dfrac{Cx+D}{(x+4)^2}$

(D) $\dfrac{A}{x-4} + \dfrac{B}{(x-4)^2} + \dfrac{C}{x+4} + \dfrac{D}{(x+4)^2}$

(E) $\dfrac{Ax+B}{x^2-16} + \dfrac{Cx+D}{(x^2-16)^2}$

(F) $\dfrac{A}{(x^2-16)^2} + \dfrac{Bx+C}{(x^2-16)^2}$

14. Determine the partial fraction decomposition of

$$\frac{7x^2+9}{x(x^2+3)}$$

Answer: _____

15. Determine the partial fraction decomposition of

$$\frac{4x - 11}{x^2 - 7x + 10}$$

Answer: _____

16. Evaluate $\int \frac{5x^2+9}{x^2(x+3)}\,dx$

$\int \frac{5x^2+9}{x^2(x+3)}\,dx$=_____

17. Evaluate $\displaystyle\int \frac{x^2+2}{x^3+3x^2+2x}\,dx$

$$\int \frac{x^2+2}{x^3+3x^2+2x}\,dx = \underline{\qquad\qquad\qquad\qquad}$$

18. Evaluate $\displaystyle\int \frac{9x^2 - 4x + 5}{(x-1)(x^2+1)}\,dx$

$$\int \frac{x^2+2}{x^3+3x^2+2x}\,dx = \underline{\qquad\qquad\qquad\qquad}$$

19. Evaluate $\displaystyle\int \frac{3x^2+3x+15}{x^3+5x^2}\,dx$

$$\int \frac{3x^2+3x+15}{x^3+5x^2}\,dx = \underline{\qquad\qquad\qquad\qquad}$$

20. 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 $[0, \pi/2]$.

21. 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 $[0, \pi/2]$.

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

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

(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 $[0, \pi/2]$.

23. Which of the following integrals are diverges?

I. $\displaystyle\int_1^\infty \frac{5}{\sqrt{x}}\,dx$ II. $\displaystyle\int_1^\infty \frac{3}{x^2}\,dx$ III. $\displaystyle\int_1^\infty \frac{10}{x}\,dx$

(A) I only

(B) II only

(C) III only

(D) I and II only

(E) I and III only

(F) I, II, and III

24. Which of the following integrals are improper?

I. $\displaystyle\int_0^{\pi/4} \cos(x)\,dx$ II. $\displaystyle\int_0^{\pi/4} \tan(2x)\,dx$ III. $\displaystyle\int_{\pi/4}^{\pi/2} \csc(x)\,dx$ IV. $\displaystyle\int_{\pi/4}^{\pi/2} \sec\left(\frac{x}{2}\right)\,dx$

(A) II and IV only

(B) I and II only

(C) I and IV only

(D) I and III only

(E) II, III and IV only

(F) II only

25. Evaluate the following integral;

$$\int_0^\infty e^{-x/6}\,dx$$

$$\int_0^\infty e^{-x/6}\,dx \quad = \quad \underline{\qquad\qquad\qquad\qquad}$$

26. Evaluate the following integral;

$$\int_0^\infty \frac{7}{e^{10x}}\,dx$$

$$\int_0^\infty \frac{7}{e^{10x}}\,dx \quad = \quad \underline{\qquad\qquad\qquad\qquad}$$

27. Evaluate the definite integral

$$\int_2^\infty \frac{dx}{5x+2}$$

$$\int_2^\infty \frac{dx}{5x+2} = \underline{\qquad\qquad\qquad\qquad}$$

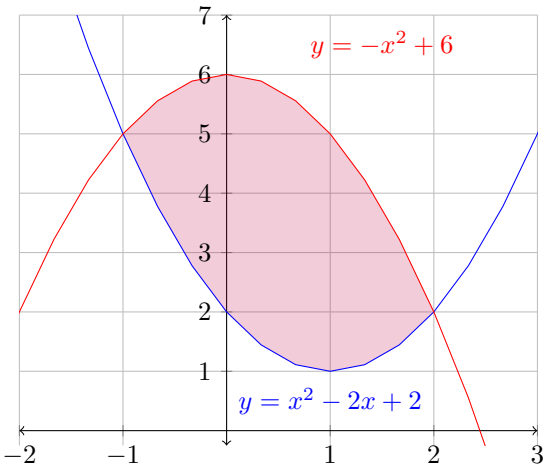
28. Evaluate the definite integral

$$\int_4^{13} \frac{dx}{\sqrt{x-4}}$$

$$\int_4^{13} \frac{dx}{\sqrt{x-4}} = \underline{\qquad\qquad\qquad\qquad}$$

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

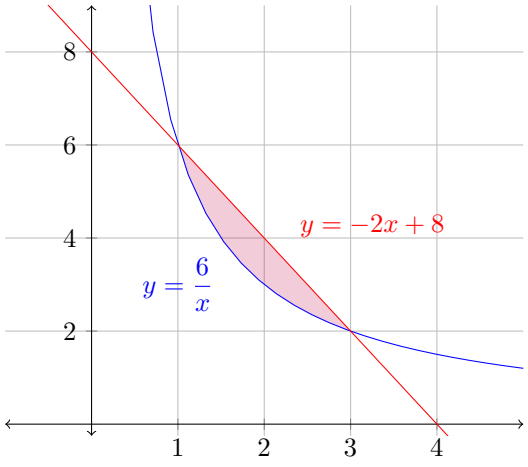
DON'T COMPUTE IT!!!



Area = $\underline{\qquad\qquad\qquad\qquad}$

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

DON'T COMPUTE IT!!!



Area = $\underline{\qquad\qquad\qquad\qquad}$

31. 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 = _____

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

$$y = x \quad \text{and} \quad y = 7x - x^2$$

Area = _____

33. Find the area of the region bounded by $y = 6x - x^2$ and $y = 2x^2$.

Area = _____

34. Find the area bounded by the following curves.

$$x = y^2 + 24 \text{ and } x = 10y$$

Area = _____

35. Find the area of the region bounded by $y = 2x - x^2$ and $y = x^2$.

Area = _____

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

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

Area = _____

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

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

Area = _____

38. 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?

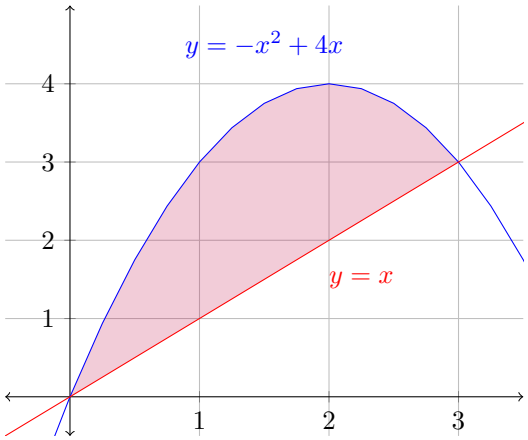
Answer: _____

39. The birthrate of a particular population is modeled by $B(t) = 1000e^{0.036t}$ people per year, and the death rate is modeled by $D(t) = 725e^{0.019t}$ people per year. How much will the population increase in the span of 10 years? $(0 \leq t \leq 20)$ Round to the nearest whole number.

Answer:_____

40. 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 = _____

41. 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 = _____

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

$$y = e^{-x}, \quad y = 4 \quad x = 0 \quad \text{and} \quad x = 10$$

about the x-axis

Volume = _____

43. Find the volume of the solid that results by revolving the region enclosed by the curves $y = \dfrac{5}{x}$, $y = 0$, $x = 5$, and $x = 7$ about the x-axis.

Volume = _____

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

$$y = 7x, \quad y = 21 \quad x = 1 \quad \text{and} \quad x = 3$$

around the x-axis

Volume = _____

45. 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 = _____

46. 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 = _____

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

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

about the x-axis

Volume = _____

48. Set up the integral that computes the **VOLUME** of the region generated by revolving the region in Quadrant I bounded by the following curves about the y-axis using the disk/washer method.

$$y = 4 - x^2, \quad y = 0 \quad \text{and} \quad x = 0$$

Volume = _____

49. Find the volume of the solid generated by revolving the region bounded by $x + y = 2$ in Quadrant I about the y-axis.

Volume = _____

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

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

around the x-axis

Volume = _____

51. Find the **VOLUME** of the solid generate by revolving the given region about the x-axis:

$$y = 8\sqrt{x}, \quad y = 0, \quad x = 3, \quad x = 6$$

Volume = _____

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

$$y = 4x^2, \quad x = 0, \quad y = 4$$

around the y-axis.

Volume = _____

53. 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 = _____

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

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

around the y-axis

Volume = _____

55. Find the **VOLUME** of the solid generated by rotating the region bounded by

$$y = x + 2, \quad x = 0, \quad y = 6$$

around the y-axis

Volume = _____

56. Find the volume of the solid generated by revolving the region bounded by the following curves about the x-axis.

$$y = 2x, \quad , y = 5x, \quad \text{and} x = 1$$

Volume = _____

57. Find the volume of the solid generated by revolving the region bounded by the following curves about the line $x = 2$

$$y = 2x, \quad , y = 0, \quad \text{and} \quad x = 1$$

Volume = _____

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

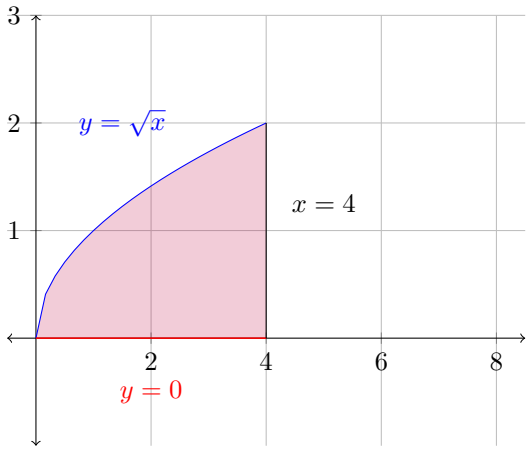
$$x + 3y = 9, \quad x = 0, \quad y = 0$$

around the y-axis

Volume = _____

59. 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 = _____

60. **SET-UP using the washer method.** the **VOLUME** of the region bounded by

$$y = x^2, \quad y = 2x$$

around the x-axis

(A) $\pi \displaystyle\int_0^2 (2x - x^2)^2 \, dx$

(B) $\pi \displaystyle\int_0^2 (4x^2 - x^4) \, dx$

(C) $\pi \displaystyle\int_0^2 (2x - x^2) \, dx$

(D) $\pi \displaystyle\int_0^2 (x^2 - 2x) \, dx$

(E) $\pi \displaystyle\int_0^2 (x^4 - 4x^2) \, dx$

(F) $2\pi \displaystyle\int_0^2 (x^3 - 2x^2) \, dx$

61. 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 = _____

62. **SET-UP using the disk/washer method.** the **VOLUME** of the region bounded by

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

around the line $y = 27$

(A) $\pi \displaystyle\int_0^{27} (729 - 162x + 9x^2)\, dx$

(B) $\pi \displaystyle\int_0^{27} 9x^2\, dx$

(C) $\pi \displaystyle\int_0^{9} 9x^2\, dx$

(D) $\pi \displaystyle\int_0^{9} (9x^2 - 162x)\, dx$

(E) $\pi \displaystyle\int_0^{27} (729 - 9x^2)\, dx$

(F) $\pi \displaystyle\int_0^{9} (729 - 162x + 9x^2)\, dx$