(30) **1.** Evaluate the following integrals.

(a) $\displaystyle\int \frac{12x^6 - \sqrt[3]{x} - 7 + 3x\sec^2(x) + 15xe^{5x+1}}{3x}dx$

(b) $\displaystyle\int 8x^2\cos(x)dx$

(c) $\displaystyle\int_{-1}^{0} (12x-3)\sqrt{2x^2-x+1}\ dx$

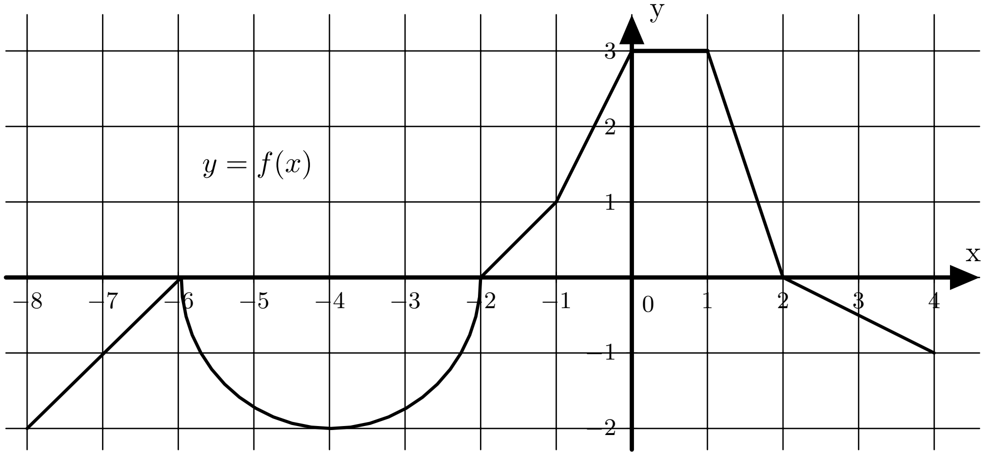
(d) $\displaystyle\int_1^e (x+2)\ln(x)dx$

(e) $\displaystyle\int \frac{4x^4+9x^3+6x^2+2x+3}{x^3+2x^2+x}dx$

(f) $\displaystyle\int_1^4 (|x-2|-x)\ dx$

(4) **2.** Approximate $\displaystyle\int_1^3 \frac{2}{\ln(x)+1}\,dx$ using a Riemann sum with right endpoints and n=4 rectangles. Round your answer to 4 decimals.

(4) **3.** The function $f(x)$ is given by the graph below. (Note that the curve is part of a circle.)

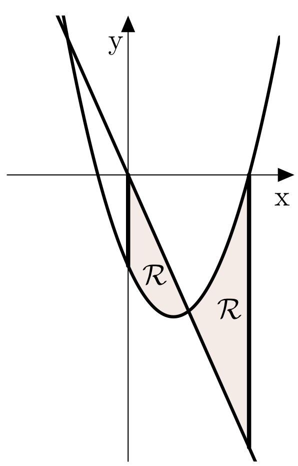


Find

(a) $\displaystyle\int_{-2}^{2} f(x)\,dx$

(b) $\displaystyle\int_{-4}^{4} f(x)\,dx$

(5) **4.** Find the area of the regions $\mathcal{R}$ (indicated in the graph at right) bounded by the curves $f(x) = x^2 - 3x - 4$ and $g(x) = -3x$, between $x = 0$ and $x = 4$.



(5) **5.** The demand function of a product is $p = \sqrt{100-x}$ and the equilibrium quantity is $x = 64$ units.

(a) Sketch and label the region whose area represents the consumer surplus.

(b) Calculate the consumer surplus.

(5) **6.** Find the function y that satisfies the differential equation $\dfrac{1}{(3x+2)}\dfrac{dy}{dx} = xy + x$ if $y(0) = 0$.

(7) **7.** The price of a component for an electronic cars is decreasing at a rate proportional to the square root of the price. The original price was \$64, and after 2 years it was \$36 .Let P be the price after t years.

(a) Write the differential equation that represents this situation.

(b) Find the equation for P.

(c) What do we expect the price to be after 4 years?

(6) **8.** Evaluate the limits. Justify your work.

(a) $\displaystyle\lim_{x\to 0^-} \frac{\sin^2(x)}{1 + x - e^x}$

(b) $\displaystyle\lim_{x\to\infty} \frac{\ln(x)}{x}$

(9) **9.** Evaluate the improper integrals and state if it converges or diverges. (Justify your answer)

(a) $\displaystyle\int_6^7 \frac{1}{x-6}\,dx$

(b) $\displaystyle\int_0^\infty \frac{e^{-x}}{(4+e^{-x})^2}\,dx$

(3) **10.** Find a formula for the n^{th} term of the sequence.

$$\left\{\frac{-5}{4}, \frac{25}{9}, \frac{-125}{16}, \frac{625}{25}, \ldots\right\}$$

(4) **11.** Does the sequence converge or diverge? If it converges, find the limit.

(a) $\left\{\dfrac{n!}{(2n+1)(n-1)!}\right\}$

(b) $\left\{(-1)^n \dfrac{n!}{(2n+1)(n-1)!}\right\}$

(15) **12.** Determine whether the following series converge or diverge. Identify which test you are using. In the case of a convergent telescoping or geometric series, find the sum.

(a) $\displaystyle\sum_{n=3}^{\infty} \left[\frac{1}{n+1} - \frac{1}{n+2}\right]$

(b) $\displaystyle\sum_{n=1}^{\infty} \frac{5^{n-1}}{2^{n+2}}$

(c) $\displaystyle\sum_{n=2}^{\infty} \frac{n!}{2^n}$

(d) $\displaystyle\sum_{n=1}^{\infty} n^{-4}\sqrt{n^5}$

(e) $\displaystyle\sum_{n=2}^{\infty} \frac{\sqrt{9n^4 - 10}}{4n^2 + 1}$

(3) **13.** To save for a post-graduation trip, a CEGEP student deposits 20\$ in a savings account every week. If the account pays 1.3% interest compounded weekly, what will the balance be after two years?

Answers:

1. (a) $\frac{2}{3}x^6 - x^{\frac{1}{3}} - \frac{7}{3}\ln|x| + \tan(x) + e^{5x+1} + C$

(b) $(8x^2 - 16)\sin x + 16x\cos x + C$

(c) -14

(d) $\frac{e^2+9}{4}$

(e) $2x^2 + x + 3\ln|x| - 3\ln|x+1| + \frac{2}{x+1} + C$

(f) -5

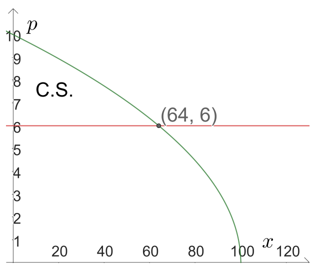
2. 2.3005

3. (a) 7

(b) $6 - \pi$

4. 16 units^2

5. (a) .



(b) \$ 138.67

6. $-1 + e^{(x^3+x^2)}$

7. (a) $\frac{dP}{dt} = k\sqrt{P}$

(b) $P = (-t+8)^2$

(c) \$16

8. (a) -2

(b) 0

9. (a) ∞, diverges

(b) $\frac{1}{20}$, converges

10. $\frac{(-5)^n}{(n+1)^2}$

11. (a) $\frac{1}{2}$, converges

(b) diverges

12. (a) telescoping, converges to $\frac{1}{4}$

(b) geometric, diverges

(c) ratio, diverges

(d) p-series, converges

(e) test for divergence, diverges

13. \$ 2107.54