

1. Find all values of c for which $f(x)$ is continuous if

$$f(x) = \begin{cases} c^2x & \text{if } x < 1 \\ 3cx - 2 & \text{if } x \geq 1 \end{cases}$$

2. What is the average value of $3t^3 - t^2$ on $-1 \leq t \leq 2$?

3. Find $\int \frac{x^2}{e^{x^3}} dx$

4. Find $\int_0^8 \frac{1}{\sqrt{1+x}} dx$

5. Find $\lim_{x \rightarrow 5} \frac{\frac{1}{x} - \frac{1}{5}}{x - 5}$

6. If $f'(x) = \sin(2x + 3)$, find $f(x)$.

7. A particle has acceleration $24t^2 \text{ ft/sec}^2$ and initial velocity 0 ft/sec . How many feet does the particle move during the first 2 seconds?

8. The Mean Value Theorem for Derivatives guarantees the existence of a special point on $y = \sqrt{x}$ for $0 \leq x \leq 4$. What are the (x, y) values of that point?

(a) $(2, \sqrt{2})$

(b) $(\frac{1}{4}, \frac{1}{2})$

(c) $(1, 1)$

(d) $(\frac{1}{2}, \frac{1}{\sqrt{2}})$

(e) none of these

9. Find $f'(e^2)$ if $f(x) = \ln(\ln(x))$.

10. Find $\int 5^{-2x} dx$

11. If $F(x) = \int_0^x e^{-t^2} dt$, find $F'(x)$.

12. Find $\int [3 \cos(\pi t) + \cos(3\pi t)] dt$

13. If $f(x) = \log_2(5x^3 - x)$, find $f'(x)$.

(a) $\frac{\ln(2)(15x^2)}{5x^3 - x}$

(b) $\frac{15x^2}{\ln(2)(5x^3 - x)}$

(c) $\frac{15x^2 - 1}{\ln(2)(5x^3 - x)}$

(d) $\frac{\ln(2)(15x^2 - 1)}{5x^3 - x}$

14. **Set up only** the integral to find the area bounded by $y = x^3$ and $y = \frac{x}{3}$.

15. Find $\int \frac{e^{5x}}{2 + e^{5x}} dx$

16. Use Newton's law of cooling to find the temperature a roast will be in 2 hours if it starts at 400° in a 68° room and cools to 350° in 30 minutes.

17. Find $\lim_{x \rightarrow -3} \frac{x + 3}{x^3 + 27}$

18. Find the surface area generated when $y = x^2$ for $1 \leq x \leq 2$ is rotated about the y -axis.

19. Find $f(x)$ if $f''(x) = 6x - 4$, $f'(2) = 5$ and $f(2) = 4$.

20. Find $\frac{d}{dx} (\sec(4^{-2x}))$

Answers

1) $c = 1$ and $c = 2$

2) $\frac{11}{4}$

3) $-\frac{1}{3}e^{-x^3} + C$

4) 4

5) $-\frac{1}{25}$

6) $-\frac{1}{2} \cos(2x + 3) + C$

7) 32

8) C

9) $\frac{1}{2e^2}$

10) $-\frac{1}{2} \frac{5^{-2x}}{\ln(5)} + C$

11) e^{-x^2}

12) $\frac{3}{\pi} \sin(\pi t) + \frac{1}{3\pi} \sin(3\pi t) + C$

13) C

14) $\int_{-\frac{1}{\sqrt{3}}}^0 x^3 - \frac{x}{3} dx + \int_0^{\frac{1}{\sqrt{3}}} \frac{x}{3} - x^3 dx$

15) $\frac{1}{5} \ln |2 + e^{5x}| + C$

16) 240.82

17) $\frac{1}{27}$

18) $\frac{\pi}{6} (17^{3/2} - 5^{3/2})$

19) $f(x) = x^3 - 2x^2 + x + 2$

20) $\sec(4^{-2x}) \tan(4^{-2x})(4^{-2x} \ln(4))(-2)$