

1. Calculate  $\frac{d}{d\theta} \int_{-2}^{\theta} \cot(u) du$ .

4. Calculate  $\frac{d}{dx} \int_2^{\cos(x)} 4^u du$ .

2. Calculate  $\frac{d}{dp} \int_{-2}^p \tan\left(\frac{1}{1+u^2}\right) du$ .

5. Calculate  $\frac{d}{dx} \int_{2x}^{x^2} \tan(t^2) dt$ .

3. Calculate  $\frac{d}{dx} \int_{100}^x \sec(5t - 9) dt$ .

6. Find the linear approximation for  $F(x) = \int_1^{x^3} \sqrt{3+t^2} + 2 dt$  at  $x = 1$ .

7. Over what interval(s) is  $F(x) = \int_1^{x^3} \sqrt{3+t^2} + 2 dt$  increasing?

8. A particle's acceleration is  $a(t) = 1 - t^3$  at any time  $t$ . If the initial position and velocity are both zero, find the velocity  $v(t)$  at any time  $t$  and the position  $s(t)$  at any time  $t$ .

9. A particle moves with velocity  $v(t) = 3t(2 - t)$  meters per second for elapsed time  $t$  and has position  $s(t)$  meters with  $s(0) = 0$ . What is the position of the particle at elapsed time  $t = 4$ ? How far has the particle traveled at elapsed time  $t = 4$ ? Hint: this is not the change in position.

10. Find the displacement of a particle moving in a straight line with velocity  $v(t) = 4t - 3$  meters per second over two time intervals: a)  $[0, 5]$ ; b)  $[1, 5]$ . Why is the displacement of the longer time interval **less** than that of the shorter time interval?

11. Evaluate  $\int_{-1}^1 (3x^2 + 1)(x^3 + x)^2 dx$ .

17. Evaluate  $\int_0^{\pi/2} \cos^3(x) \sin(x) dx$ .

12. Evaluate  $\int_{\pi^2/9}^{\pi^2} \frac{\cos(\sqrt{x})}{\sqrt{x}} dx$ .

18. Evaluate  $\int_2^{12} \frac{dy}{3y + 4}$ .

13. Evaluate  $\int \sec(\theta) \tan(\theta)(\sec(\theta) - 1) d\theta$ .

19. Evaluate  $\int_{-1}^{\sqrt{3}} \frac{\tan^{-1}(x)}{1+x^2} dx$ .

14. Evaluate  $\int \frac{e^t}{e^{2t} + 2e^t + 1} dt$ .

20. Evaluate  $\int \frac{t}{\sqrt{7-t^2}} dt$ .

15. Evaluate  $\int_1^e \frac{(\ln(p))^4}{p} dp$ .

21. Evaluate  $\int e^x \cos(e^x) dx$ .

16. Evaluate  $\int_0^{\sqrt{e-1}} \frac{x^3}{1+x^2} dx$ .

22. Evaluate  $\int \frac{4 \ln(x) + 5}{x} dx$ .

23. CAS problem (3 points): use a CAS device to solve the following problems. Submit a printed copy of the device's solution and your corresponding commands.

Find exact answers for the following.

A)  $\int_0^{\pi/2} x^4 \cos(x) dx$

B)  $\int_0^{\pi} \sin(3x) \cos(x) dx$

C)  $\int_{-1}^3 x^3 e^{x^2} dx$

**Brief answers**

1.  $\cot(\theta)$

13.  $\frac{(\sec(\theta) - 1)^2}{2} + C$

2.  $\tan\left(\frac{1}{1+p^2}\right)$

14.  $-(e^t + 1)^{-1} + C$

3.  $\sec(5x - 9)$

15.  $\frac{1}{5}$

4.  $-4^{\cos(x)} \sin(x)$

16.  $\frac{e - 2}{2}$

5.  $2x \tan(x^4) - 2 \tan(4x^2)$

17.  $\frac{1}{4}$

6.  $12x - 12$

7.  $(-\infty, \infty)$ ; it always increases.

18.  $\frac{\ln(4)}{3}$

8.  $s(t) = \frac{10t^2 - t^5}{20}$ ;  $v(t) = t - \frac{t^4}{4}$

19.  $\frac{7\pi^2}{288}$

9.  $s(4) = -16$  meters; Distance = 24 meters.

20.  $-\sqrt{7 - t^2} + C$

10. a) 35 meters; b) 36 meters

21.  $\sin(e^x) + C$

11.  $\frac{16}{3}$

22.  $\frac{(4 \ln(x) + 5)^2}{8} + C$

12.  $-\sqrt{3}$