

$$\int \pi \sin \pi x \, dx$$

$$u = \pi x$$

$$du = \pi$$

$$-\cos \pi x + C$$

$$\int 4x^3 \sin x^4 \, dx$$

$$u = x^4$$

$$du = 4x^3$$

$$-\cos(x^4) + C$$

$$\int \sin 2x \, dx$$

$$u = 2x$$

$$du = 2$$

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

$$\int \cos 6x \, dx$$

$$u = 6x$$

$$du = 6$$

$$\frac{1}{6} \sin(6x) + C$$

$$\int \frac{1}{2} \cos \frac{1}{\theta} \, d\theta$$

$$u = \frac{1}{\theta}$$

$$du = -\theta^{-2} \, d\theta$$

$$-\sin(\frac{1}{\theta}) + C$$

$$\int \cos \frac{1}{\theta} \, d\theta$$

$$u = \frac{1}{\theta}$$

$$du = -\theta^{-2} \, d\theta$$

$$-\sin(\frac{1}{\theta}) + C$$

$$\int x \sin x^2 \, dx$$

$$u = x^2$$

$$du = 2x$$

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

$$\int \sin(2x) \cos 2x \, dx$$

$$u = \cos(2x)$$

$$du = \sin(2x) \cdot 2$$

$$\frac{1}{2} \int \sin u \, du$$

$$-\frac{1}{4} \sin^2(2x) + C$$

$$\int \sec(1-x) \tan(1-x) \, dx$$

$$u = \sec(1-x)$$

$$du = \sec(1-x) \tan(1-x) \cdot (-1)$$

$$-u + C$$

$$-(\sec(1-x)) + C$$

$$\int 1 \, du$$

$$u = \sec(1-x)$$

$$du = \sec(1-x) \tan(1-x) \cdot (-1)$$

$$-u + C$$

$$-(\sec(1-x)) + C$$

49. $\int \tan^4(x) \sec^2(x) \, dx$

$$u = \tan x$$

$$du = \sec^2 x \, dx$$

$$\int u^4 \, du$$

$$\frac{1}{5} \tan^5(x) + C$$

50. $\int u^{1/2} \, du$

$$\frac{2}{3} (\tan x)^{3/2} + C$$

55. $\int \cos \frac{x}{2} \, dx$

$$u = \frac{x}{2}$$

$$2u = x$$

$$2du = dx$$

$$2 \int \cos u \, du$$

$$2 \sin \frac{x}{2} + C$$

$$2 \sin \frac{x}{2} + C$$

56. $\int \pi \sec \pi x \tan \pi x \, dx$

$$u = \sec \pi x$$

$$du = \sec \pi x \tan \pi x \cdot \pi \, dx$$

$$u + C$$

$$\sec \pi x + C$$

57. $\int x \sqrt{x+2} \, dx$

$$u = \sqrt{x+2}$$

$$u^2 - 2 = x$$

$$2u \, du = dx$$

$$2 \int (u^2 - 2) \cdot u \cdot u \, du$$

$$2 \int u^4 - 2u^2 \, du$$

$$2 \left[\frac{1}{5} u^5 - \frac{2}{3} u^3 + C \right]$$

$$\frac{2}{5} (\sqrt{x+2})^5 - \frac{4}{3} (\sqrt{x+2})^3 + C$$

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Supplemental Problems FTM

$$\begin{cases} g(x) = \int f(t) \\ g'(x) = f(t) \\ g''(x) = f'(t) \end{cases}$$

3. $G(x) = \int_1^x t^2 - 2 \, dt$

$$G(1) = 0 \quad G'(1) = -1 \quad G'(2) = 2$$

$$G(x) = \frac{1}{3} x^3 - 2x + \frac{5}{3}$$

4. $F(x) = \int_0^x \sqrt{t^2 + t} \, dt$

$$F(0) = 0 \quad F'(0) = 0 \quad F'(3) = \sqrt{12}$$

5. $G(x) = \int_1^x \tan(t) \, dt$

$$G(1) = 0 \quad G'(0) = 0 \quad G'(\pi/4) = 1$$

6. $H(x) = \int_{-2}^x \frac{1}{u^2 + 1} \, du$

$$H(-2) = 0 \quad H'(-2) = \frac{1}{5}$$

7. $\int_2^x u^4 \, du = \frac{1}{5} u^5 + C \Big|_2^x$

$$\frac{1}{5} x^5 - \frac{32}{5}$$

8. $\int_2^x (12t^2 - 8t) \, dt = 4t^3 - 4t^2 + C \Big|_2^x$

$$4x^3 - 4x^2 - 16$$

9. $\int_0^x \sin u \, du = -\cos x + 1$

28. $G'(x) = \sqrt{x^4 + 3} \cdot 2x$

10. $\int_{-\pi/4}^x \sec^2 \theta = \tan x + 1$

$$G'(1) = 4$$

- 21. $x^5 - 9x^3$
- 22. $\cot \theta$
- 23. $\sec(5t - 9)$
- 24. $\tan(\frac{1}{t+2}) - \tan(\frac{1}{5})$

25. a) $A(2) = 4 \quad A(3) = 6 \frac{1}{2}$

$$A'(2) = 2 \quad A'(3) = 3$$

b) $y = 2 \cdot [0, 2]$

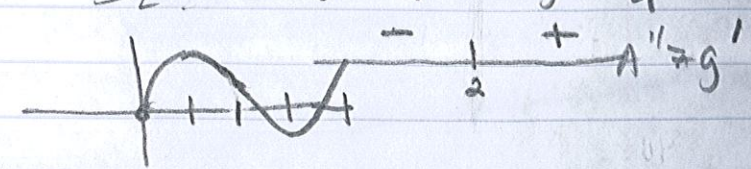
$$y = x - [2, 4]$$

$$A = 2x + C \Big|_0^2 \quad A(0) = 0$$

$$A = \frac{1}{2} x^2 + C_2 \Big|_2^4 \quad C = 0$$

$$A(2) = 4 \quad C = 2$$

$\begin{cases} 2x & 0 \leq x \leq 2 \\ \frac{1}{2} x^2 & 2 < x \leq 4 \end{cases} \quad A' = 9$



$$u = x^4 \quad du = 4x^3$$

$$\frac{1}{4} \sin(x^4) + C$$

$$u = x^3 + 1 \\ du = 3x^2 dx$$

$$\frac{1}{3} \sin(x^3 + 1) + C$$

$$25, u = x^{3/2} \quad du = \frac{3}{2} x^{1/2}$$

$$\frac{2}{3} \sin(x^{3/2}) + C$$

$$26, u = \sin(x) \quad du = \cos x dx$$

$$\sin(\sin x) + C$$

$$43. a) A'' = 0 \Rightarrow f'$$

$$\therefore f' = 0$$

$$b) A'' > 0 \Rightarrow f' > 0$$

$\therefore f$ inc,

$$c) A'' < 0 \Rightarrow f' < 0$$

$\therefore f$ dec,

2, 2x

$$44. a) i) A \downarrow A' < 0 f < 0$$

$$b) ii) A' + to - f + to -$$

$$c) iV) A'' > 0 A' \uparrow \rightarrow f \uparrow$$

$$d) iii) A'' \text{ goes } + \text{ to } - \Rightarrow \\ f' + \text{ to } - \text{ } f \text{ is max}$$

$$\ln(\sqrt{x}) = \frac{1}{2} x^{-1/2}$$

4.5

1/4

2 1/4

4.5

= -3

= -2

19

-18

$$45. a) \text{ inc } (0, 4) \cup (8, 12)$$

$$\text{dec } (4, 8) \cup (12, \infty)$$

$$b) \text{ min } x = 8$$

$$\text{max } x = 4 \quad x = 12$$

$$c) x = 2 \quad x = 6 \quad x = 10$$

$$d) \text{ CCU } (0, 2) \cup (6, 10)$$

$$\text{CCD } (2, 6) \cup (10, 12)$$

$$48. a) x = \pi \text{ max}$$