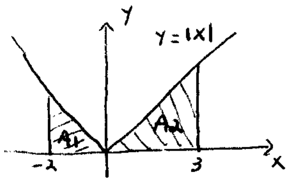
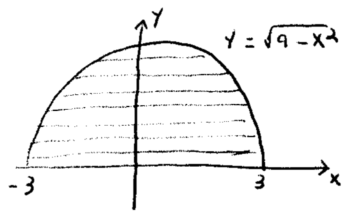
(61) $$\int_{-2}^{3} |x|\,dx = A_1 + A_2 = \tfrac{1}{2}\cdot 2\cdot 2 + \tfrac{1}{2}\cdot 3\cdot 3 = \tfrac{4}{2} + \tfrac{9}{2} = \boxed{\tfrac{13}{2}}$$

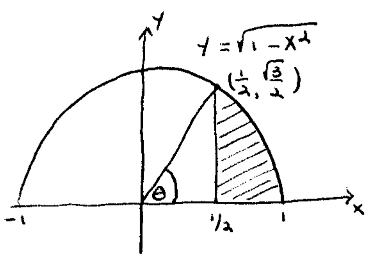


(62) $$\int_{-3}^{3} \sqrt{9-x^2}\,dx = \tfrac{1}{2}(\pi r^2) = \tfrac{1}{2}(\pi\cdot 3^2) = \boxed{\tfrac{9\pi}{2}}$$

(SINCE $y = \sqrt{9-x^2}$ IS THE TOP HALF OF THE CIRCLE $x^2+y^2=9$).



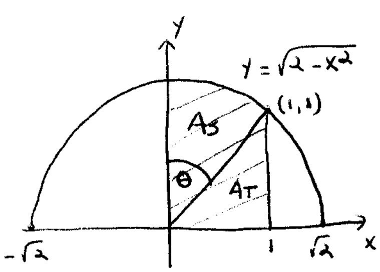
(64) $$\int_{1/2}^{1} \sqrt{1-x^2}\,dx = A_S - A_T = \tfrac{1}{2}r^2\theta - \tfrac{1}{2}bh = \tfrac{1}{2}\cdot 1^2\cdot\tfrac{\pi}{3} - \tfrac{1}{2}\cdot\tfrac{1}{2}\cdot\tfrac{\sqrt{3}}{2} = \boxed{\tfrac{\pi}{6} - \tfrac{\sqrt{3}}{8}}$$



(IF $x = \tfrac{1}{2}$, $y = \sqrt{1-\tfrac{1}{4}} = \sqrt{\tfrac{3}{4}} = \tfrac{\sqrt{3}}{2}$

SO $\tan\theta = \dfrac{y}{x} = \dfrac{\sqrt{3}/2}{1/2} = \sqrt{3}$ AND $\underline{\theta = \tfrac{\pi}{3}}$)

(66)



$\tan\theta = \dfrac{y}{x} = \dfrac{1}{1} = 1$, SO $\underline{\theta = \tfrac{\pi}{4}}$

$$\int_{0}^{1} \sqrt{2-x^2}\,dx = A_S + A_T = \tfrac{1}{2}r^2\theta + \tfrac{1}{2}bh$$

$$= \tfrac{1}{2}(\sqrt{2})^2\cdot\tfrac{\pi}{4} + \tfrac{1}{2}\cdot 1\cdot 1 = \boxed{\tfrac{\pi}{4} + \tfrac{1}{2}} = \boxed{\tfrac{\pi+2}{4}}$$

(4) $$\int_0^2 (x^3+16x)\,dx = \left[\frac{x^4}{4}+8x^2\right]_0^2 = (4+32)-0 = \boxed{36}$$

(5) $$\int_{-1}^0 (4x+10)\,dx = \left[2x^2+10x\right]_{-1}^0 = 0-(2-10) = \boxed{8}$$

(6) $$\int_0^3 (x-4)(x+2)\,dx = \int_0^3 (x^2-2x-8)\,dx = \left[\frac{x^3}{3}-x^2-8x\right]_0^3$$

$$= (9-9-24)-0 = \boxed{-24}$$

(7) $$\int_1^5 \frac{9x+5}{x^2}\,dx = \int_1^5 \left(\frac{9x}{x^2}+\frac{5}{x^2}\right)dx = \int_1^5 \left(\frac{9}{x}+5x^{-2}\right)dx$$

$$= \left[9\ln x - 5x^{-1}\right]_1^5 = \left[9\ln x - \frac{5}{x}\right]_1^5$$

$$= (9\ln 5 - 1) - (\underset{\substack{\uparrow\\0}}{9\ln 1} - 5) = \boxed{9\ln 5 + 4}$$

(8) $$\int_1^4 \frac{3x+8}{\sqrt{x}}\,dx = \int_1^4 (3x+8)x^{-1/2}\,dx = \int_1^4 (3x^{1/2}+8x^{-1/2})\,dx$$

$$= \left[3\left(\tfrac{2}{3}x^{3/2}\right)+8\left(2x^{1/2}\right)\right]_1^4 = \left[2x^{3/2}+16x^{1/2}\right]_1^4$$

$$= (2\cdot 8+16\cdot 2)-(2+16) = \boxed{30}$$

(9) $$\int_0^{\pi/3} (4\cos x + 6\sec^2 x)\,dx = \left[4\sin x + 6\tan x\right]_0^{\pi/3}$$

$$= \left(4\cdot\frac{\sqrt{3}}{2}+6\cdot\sqrt{3}\right)-(4\cdot 0+6\cdot 0) = \boxed{8\sqrt{3}}$$

(20) $Y = \int_2^{x^2-2} \sqrt{3+u}\, du \qquad \frac{dY}{dx} = \sqrt{3+(x^2-2)} \cdot 2x = \boxed{\sqrt{x^2+1} \cdot 2x}$

(31) $Y = \int_{x^2}^{1} \sec t\, dt = -\int_1^{x^2} \sec t\, dt$ so $\frac{dY}{dx} = \boxed{-\sec x^2 \cdot 2x}$

(35) $Y = \int_{x^2}^{x^3} \ln(t-3)\, dt = \int_2^{x^3} \ln(t-3)\, dt - \int_2^{x^2} \ln(t-3)\, dt$, so

$\frac{dY}{dx} = \boxed{\ln(x^3-3) \cdot 3x^2 - \ln(x^2-3) \cdot 2x}$

REMARK Notice that Y is only defined where $x^2 > 3$ and $x^3 > 3$, so it is defined on $(\sqrt{3}, \infty)$.

(73) $\int (\sec^2 x + \tan x)\, dx = \tan x + \int \frac{\sin x}{\cos x}\, dx = \tan x - \int \frac{-\sin x}{\cos x}\, dx$

$= \boxed{\tan x - \ln|\cos x| + C}$ (using the Log Rule)

REMARK We can also write the answer as $\boxed{\tan x + \ln|\sec x| + C}$, since $-\ln|\cos x| = \ln|\cos x|^{-1} = \ln \frac{1}{|\cos x|} = \ln\left|\frac{1}{\cos x}\right| = \ln|\sec x|$.

(97) $\int_2^4 (3-2x)\, dx = \left[3x - x^2\right]_2^4 = (12-16)-(6-4) = \boxed{-6}$

(109) $\int_0^1 \frac{1}{1+x^2}\, dx = \left[\tan^{-1} x\right]_0^1 = \tan^{-1} 1 - \tan^{-1} 0 = \frac{\pi}{4} - 0 = \boxed{\frac{\pi}{4}}$

(119) $\int_1^e \frac{1}{x}\, dx = \left[\ln x\right]_1^e = \ln e - \ln 1 = 1 - 0 = \boxed{1}$