1. $\frac{d}{dx}\left[\sqrt{x^2+1}+C\right]=\frac{d}{dx}\left[\left(x^2+1\right)^{1/2}+C\right]=\frac{1}{2}\left(x^2+1\right)^{-1/2}\cdot 2x=\frac{x}{\sqrt{x^2+1}}$

6. $\int\sqrt[3]{x}\,dx=\int x^{1/3}dx=\frac{x^{4/3}}{4/3}+C=\frac{3}{4}x^{4/3}+C$

7. $\int\left(x^3+6x+1\right)dx=\frac{x^4}{4}+6\frac{x^2}{2}+x+C=\frac{1}{4}x^4+3x^2+x+C$

9. $\int(1-t)\left(2+t^2\right)dt=\int\left(2-2t+t^2-t^3\right)dt=2t-2\frac{t^2}{2}+\frac{t^3}{3}-\frac{t^4}{4}+C=2t-t^2+\frac{1}{3}t^3-\frac{1}{4}t^4+C$

13. $\int\frac{\sin x}{1-\sin^2 x}dx=\int\frac{\sin x}{\cos^2 x}dx=\int\frac{1}{\cos x}\cdot\frac{\sin x}{\cos x}dx=\int\sec x\tan x\,dx=\sec x+C$

21.

$$\int_{-2}^{2}(3u+1)^2du=\int_{-2}^{2}\left(9u^2+6u+1\right)du=\left[9\cdot\frac{1}{3}u^3+6\cdot\frac{1}{2}u^2+u\right]_{-2}^{2}=\left[3u^3+3u^2+u\right]_{-2}^{2}$$

$$=(24+12+2)-(-24+12-2)=38-(-14)=52$$

23. $\int_1^4\sqrt{t}\,(1+t)dt=\int_1^4(t^{1/2}+t^{3/2})dt=\left[\frac{2}{3}t^{3/2}+\frac{2}{5}t^{5/2}\right]_1^4=\left(\frac{16}{3}+\frac{64}{5}\right)-\left(\frac{2}{3}+\frac{2}{5}\right)=\frac{14}{3}+\frac{62}{5}=\frac{256}{15}$

30.

$$\int_1^9\frac{3x-2}{\sqrt{x}}dx=\int_1^9(3x^{1/2}-2x^{-1/2})dx=\left[3\cdot\frac{2}{3}x^{3/2}-2\cdot 2x^{1/2}\right]_1^9=\left[2x^{3/2}-4x^{1/2}\right]_1^9$$

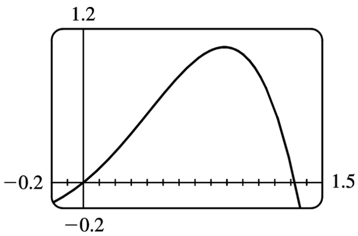
$$=(54-12)-(2-4)=44$$

31. $\int_0^{\pi}(4\sin\theta-3\cos\theta)d\theta=[-4\cos\theta-3\sin\theta]_0^{\pi}=(4-0)-(-4-0)=8$

41. The graph shows that $y=x+x^2-x^4$ has $x-$ intercepts at $x=0$ and at $x=a\approx 1.32$. So the area of the region that lies under the curve and above the $x-$ axis is

$$\int_0^a\left(x+x^2-x^4\right)dx=\left[\frac{1}{2}x^2+\frac{1}{3}x^3-\frac{1}{5}x^5\right]_0^a$$

$$=\left(\frac{1}{2}a^2+\frac{1}{3}a^3-\frac{1}{5}a^5\right)-0$$
$$\approx 0.84$$



45. If $w'(t)$ is the rate of change of weight in pounds per year, then $w(t)$ represents the weight in pounds of the child at age t. We know from the Net Change Theorem that $\int_5^{10} w'(t)\,dt=w(10)-w(5)$, so the integral represents the increase in the child's weight (in pounds) between the ages of 5 and 10.

47. Since $r(t)$ is the rate at which oil leaks, we can write $r(t)=-V'(t)$, where $V(t)$ is the volume of oil at time t. Thus, by the Net Change Theorem, $\int_0^{120} r(t)\,dt=-\int_0^{120} V'(t)\,dt=-[V(120)-V(0)]=V(0)-V(120)$, which is the number of gallons of oil that leaked from the tank in the first two hours (120 minutes).

54. **(a)** displacement $=\int_1^6 \left(t^2-2t-8\right)dt=\left[\frac{1}{3}t^3-t^2-8t\right]_1^6=(72-36-48)-\left(\frac{1}{3}-1-8\right)=-\frac{10}{3}$ m

(b)

distance traveled $=\int_1^6 |t^2-2t-8|\,dt=\int_1^6 |(t-4)(t+2)|\,dt$

$$=\int_1^4\left(-t^2+2t+8\right)dt+\int_4^6\left(t^2-2t-8\right)dt=\left[-\frac{1}{3}t^3+t^2+8t\right]_1^4+\left[\frac{1}{3}t^3-t^2-8t\right]_4^6$$
$$=\left(-\frac{64}{3}+16+32\right)-\left(-\frac{1}{3}+1+8\right)+(72-36-48)-\left(\frac{64}{3}-16-32\right)=\frac{98}{3}\text{ m}$$

55. **(a)** $v'(t)=a(t)=t+4\Rightarrow v(t)=\frac{1}{2}t^2+4t+C\Rightarrow v(0)=C=5\Rightarrow v(t)=\frac{1}{2}t^2+4t+5$ m / s

(b)

distance traveled $=\int_0^{10}|v(t)|\,dt=\int_0^{10}\left|\frac{1}{2}t^2+4t+5\right|dt=\int_0^{10}\left(\frac{1}{2}t^2+4t+5\right)dt$

$$=\left[\frac{1}{6}t^3+2t^2+5t\right]_0^{10}=\frac{500}{3}+200+50=416\,\frac{2}{3}\text{ m}$$

58. By the Net Change Theorem, the amount of water that flows from the tank is
$\int_0^{10} r(t)dt = \int_0^{10} (200 - 4t)\,dt = \left[200t - 2t^2\right]_0^{10} = (2000 - 200) - 0 = 1800$ liters.