1. a) LHS $= 4(10+12+9+12+25) = \boxed{272 \text{ feet}}$

RHS $= 4(12+9+12+25+22) = \boxed{320 \text{ feet}}$

b) Upper $= 4(12+12+12+25+25) = \boxed{344 \text{ feet}}$

Lower $= 4(10+9+9+12+22) = \boxed{248 \text{ feet}}$

2. a) $\int_0^7 f(x)dx = 4-4-8-3 = \boxed{-11}$

b) $\int_8^{10} f(x)dx = F(10)-F(8) \Rightarrow F(8) = F(10) - \int_8^{10} f(x)dx = -10-4 = \boxed{-14}$

3. a) $[w]\cdot[t] = \boxed{\text{workers} \cdot \text{hours}}$ (i.e. man-hours)

b) $\int_a^b I(t)dt = \int_a^b \frac{dQ}{dt}dt = Q(b)-Q(a) \Rightarrow \int_a^b I(t)dt$ represents the total change in charge between $t=a$ and $t=b$.

4. Total area $= 100 + \int_0^7 5\ln(t+1)dt = 65 + 40\ln(8) \approx \boxed{148.2 \text{ m}^2}$

5. a) $\int_0^{10}(3f(t)-4g(t)+5)dt = 3\int_0^{10} f(t)dt - 4\int_0^{10} g(t)dt + 5\int_0^{10} dt$

$= 3\cdot 12 - 4\cdot{-3} + 5\cdot 10 = \boxed{98}$

b) $\int_{10}^0 \left(-\frac{g(t)}{6}\right)dt = -\frac{1}{6}\int_{10}^0 g(t)dt = +\frac{1}{6}\int_0^{10} g(t)dt = \frac{1}{6}\cdot{-3} = \boxed{-\frac{1}{2}}$

c) $g(t)$ is odd $\Rightarrow \int_{-10}^{10} g(t)dt = 0 \Rightarrow \int_{-10}^0 g(t)dt + \int_0^{10} g(t)dt = 0 \Rightarrow \int_{-10}^0 g(t)dt = -\int_0^{10} g(t)dt$

$\Rightarrow \int_{-10}^0 g(t)dt = -(-3) = \boxed{3}$

d) $\int_{-10}^{10}(f(t)+g(t))dt = \int_{-10}^{10} f(t)dt + \int_{-10}^{10} g(t)dt = 2\cdot\int_0^{10} f(t)dt + 0 = 2\cdot 12 = \boxed{24}$

6. a) $\int (a^2x+\sqrt{b})\,dx = a^2\cdot\frac{x}{2}+\sqrt{b}\,x + C = \boxed{\frac{1}{2}a^2x+\sqrt{b}\,x+C}$

b) $\int \left(e^{2t}+\frac{1}{2t}\right)dt = \boxed{\frac{1}{2}e^{2t}+\frac{1}{2}\ln(|t|)+C}$

c) $\int z^2(z^8+4z^4+4)\,dz = \int (z^{10}+4z^6+4z^2)\,dz = \boxed{\frac{z^{11}}{11}+\frac{4z^7}{7}+\frac{4z^3}{3}+C}$

d) $\int \frac{3}{\sqrt{kt}}\,dt = \frac{3}{\sqrt{k}}\int t^{-1/2}\,dt = \frac{3}{\sqrt{k}}\cdot\frac{t^{1/2}}{1/2}+C = \boxed{6\sqrt{\frac{t}{k}}+C}$

7. a) $\frac{1}{2}\int_{-5}^{5} e^x\,dx = \frac{1}{2}\left[e^x\Big|_{-5}^{5}\right] = \boxed{\frac{1}{2}\left(e^5-e^{-5}\right)}$ or sinh(5)!

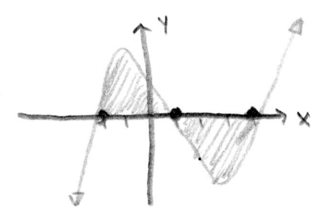
b) $c\int_1^5 \frac{1}{t}\,dt = c\left[\ln(|t|)\Big|_1^5\right] = c(\ln(5)-\ln(1)) = \boxed{c\ln(5)}$

c) $\int_0^1 x^{n-1}\,dx = \frac{x^n}{n}\Big|_0^1 = \boxed{\frac{1}{n}}$

d) $\frac{8}{3}\int_1^8 x^{-5/3}\,dx = \frac{8}{3}\left(\frac{x^{-2/3}}{-2/3}\Big|_1^8\right) = -4\cdot\frac{1}{\sqrt[3]{x^2}}\Big|_1^8 = -4\left(\frac{1}{\sqrt[3]{64}}-\frac{1}{\sqrt[3]{1}}\right) = -4\left(\frac{1}{4}-1\right) = \boxed{3}$

8. $H(s) = \int 3(s+1)^2\,ds = 3\int (s^2+2s+1)\,ds = 3\left(\frac{s^3}{3}+2\frac{s^2}{2}+s+C\right) = s^3+3s^2+3s+C$

$H(1)=4 \Rightarrow 1+3+3+C=4 \Rightarrow C=-3 \Rightarrow \boxed{H(s)=s^3+3s^2+3s-3}$

9. a) 

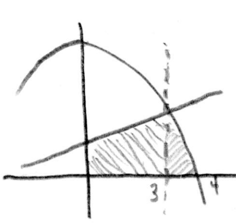
area $= \int_{-2}^{1}\left((x-1)^3-9x+9\right)dx - \int_{1}^{4}\left((x-1)^3-9x+9\right)dx =$

$= 20.25-(-20.25) = \boxed{40.5}$

b) Intersection: $16-x^2 = x+4 \Rightarrow x=-4,7$

Upper limit: $16-x^2=0 \Rightarrow x=-4,4$

$\Rightarrow$ area $= \int_0^3 (x+4)\,dx + \int_3^4 (16-x^2)\,dx = \cdots$



$\cdots = \left(\frac{x^2}{2}+4x\right)\Big|_0^3 + \left(16x-\frac{x^3}{3}\right)\Big|_3^4 = \left[\left(\frac{9}{2}+12\right)-0\right] + \left(\left(64-\frac{64}{3}\right)-\left(48-\frac{27}{3}\right)\right)$

$= \boxed{\frac{121}{6}}$

10. $F(x) = \int_0^x \frac{1}{1+t+t^2}\,dt$

a) $F(0) = \int_0^0 \frac{1}{1+t+t^2}\,dt = \boxed{0}$

b) $F'(x) = \frac{1}{1+x+x^2}$

c) $1+x+x^2 = 0$ has no zeros $\Rightarrow 1+x+x^2 > 0$ for all x

$\Rightarrow F'(x) = \frac{1}{1+x+x^2} > 0$ for all $x \Rightarrow$ $\boxed{F(x) \text{ is increasing everywhere}}$

d) $F''(x) = \frac{-(1+2x)}{(1+x+x^2)^2} = 0 \Rightarrow x = -\frac{1}{2} \Rightarrow \begin{cases} F''(x) < 0 & \text{for } x > -\frac{1}{2} \\ F''(x) > 0 & \text{for } x < -\frac{1}{2} \end{cases}$

$\Rightarrow$ $F(x)$ is concave $\boxed{\text{up for } x < -\frac{1}{2}}$ and concave $\boxed{\text{down for } x > -\frac{1}{2}}$