1. 0—Using $y' = \frac{-1}{x^2}$ and $y = \frac{-4}{9}x + \frac{1}{3}$, then setting the slopes =, gives $x = \pm\frac{3}{2}$ & $y = \pm\frac{2}{3}$ & the sum is 0.

2. -160—a) Avg. velocity $= \frac{\Delta s}{\Delta t} = \frac{-96-32}{3-1} = -64$. b) $v = -32t \Rightarrow v(3) = -96$. Sum is -160.

3. $\frac{1+100\pi^2}{\pi}$ --a) $\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt} \Rightarrow 4 = 4\pi \frac{dr}{dt} \Rightarrow \frac{dr}{dt} = \frac{1}{\pi}$. b) $\frac{dA}{dt} = 2\pi r \frac{dr}{dt} = 20\pi \cdot 5 = 100\pi$. Sum to get ans.

4. $\frac{297}{2}$ --a) Isect pts. are y =2 & -1. $A = \int_{-1}^{2} [y - (y^2 - 2)]dy = \frac{9}{2}$. b) $A = 2\int_0^3 2\sqrt{9 - x^2}\,dx = 144$. Sum to get ans.

5. 34—a) Approx of $f'(2) = \frac{15-21}{3-1} = -3$. b) Let $u = x^2, du = 2xdx \Rightarrow \frac{1}{2}\int f'(u)du = \frac{1}{2}f(u) = \frac{1}{2}f(x^2)|_0^2 = 4$.
c) Using integration by parts and $u = x, dv = f''(x)dx,$ then $du = dx, v = f'(x)$
$\Rightarrow xf'(x)|_1^3 - \int_1^3 f'(x)dx = 33$. Sum to get answer.

6. $\frac{3}{2} + \sqrt{122}$ --a) Speed $= \sqrt{(x'(0))^2 + (y'(0))^2} = \sqrt{(-1)^2 + 11^2} = \sqrt{122}$. b) $\lim_{t\to\infty} \frac{dy}{dx} = \lim_{t\to\infty} \frac{9e^{3t} + 2e^{-2t}}{6e^{3t} - 7e^{-7t}} = \frac{3}{2}$.

7. 0—a) The derivative is never 0 so there are not relative extrema and it is always positive, so the absolute max occurs at the right endpoint, x = 10. b) The derivative is never 0 so there are not relative extrema and it is always positive, so the absolute min occurs at the left endpoint, x = -10. c) The derivative increases from x = -10 to x = 0, indicating the function is concave up there. The derivative decreases from x = 0 to x = 10, indicating the function is concave down there. So, x = 0 is the point of inflection. Sum to get answer.

8. 65—a) $f'(x) = 12x^2 + 2ax + b$ and $f''(x) = 24x + 2a \Rightarrow f''(-2) = -48 + 2a = 0 \Rightarrow a = 24$.
b) $f'(-1) = 12 - 2a + b = 12 - 2(24) + b = 0 \Rightarrow b = 36$.
k) $\int_0^1 (4x^3 + 24x^2 + 36x + k)dx = 36 \Rightarrow 27 + k = 36 \Rightarrow k = 5$. Sum to get answer.

9. $\frac{130}{3}$ --a) $A = \int_0^2 (5 - (x^2 + 1))dx = \frac{16}{3}$. b) $A = \int_1^3 (3x^2 + 2x)dx = 34$. c) $A = \int_0^{2\pi} \sin\left(\frac{x}{2}\right)dx = 4$. Sum to get ans.

10. $xe^x + 3x^2e^{x^3} - e^{\sin x}$ --a) $\frac{d}{dx}\int_2^{e^x} \ln(t)dt = e^x \ln e^x = xe^x$. b) $\frac{d}{dx}\int_e^{x^3} e^t dt = 3x^2e^{x^3}$
c) $\frac{d}{dx}\int_x^3 e^{\sin t}dt = -\frac{d}{dx}\int_3^x e^{\sin t}dt = -e^{\sin x}$. Sum to get answer.

11. $\frac{64\pi}{3}$--a) $V=\pi\int_0^2[(4x-x^2)^2-x^4]dx=\frac{32\pi}{3}$. b) $V=2\pi\int_0^2(3-x)(4x-2x^2)dx=\frac{32\pi}{3}$. Sum to get answer.

12. $\frac{163}{15}$--a) A.V.$=\frac{1}{5}\int_4^9\sqrt{x}dx=\frac{38}{15}$. b) A.V.$=\frac{1}{5}\int_0^5 x\sqrt{25-x^2}\,dx$ (use u-sub) $=\frac{125}{15}$. Sum to get answer.

13. 8-- $L=\int_0^{2\pi}\sqrt{(1-\cos t)^2+(\sin t)^2}\,dt=2\int_0^{2\pi}\sqrt{\frac{1-\cos t}{2}}dt=2\int_0^{2\pi}\sin\left(\frac{t}{2}\right)dt=8.$

14. $\frac{\pi}{2}$-- $A=\frac{1}{2}\cdot 8\int_0^{\frac{\pi}{4}}\cos^2 2\theta d\theta=\frac{\pi}{2}$.