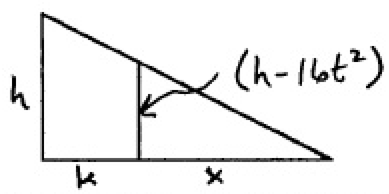
1. $\boxed{y=2x-3 \;\&\; y=2x+3}$ From the first equation, we get $\frac{dy}{dx}=\frac{-2}{(x-1)^2}$. The slope of the 2nd equation is 2.

Therefore, $\frac{(x-1)^2}{2}=2$ (slope of $\perp$). This gives x = -1 or 3, which give the required equations.

2. $\boxed{-3}$ $P(0)=1$ implies $d=1$ and $a=c=0$ due to symmetry. $P(q)=q^4+bq^2+1=-3$ and $P'(q)=4q^3+2bq=0$. Solving this 2nd equation gives $q=0$ or $b=-2q^2$. Plugging into the 1st equation gives b = -4 and $a+b+c+d=-3$.

3. $\boxed{2\text{ weeks}}$ Let x = the number of weeks to wait. Income = $I=(160+40x)(2-.2x-.05x)=10(32+4x-x^2)$. $I'=10(4-2x)=0$ at x=2. The 2nd derivative is negative, meaning that x = 2 is a max.

4. $\boxed{-kh}$ $\frac{x}{h-16t^2}=\frac{k}{16t^2}\Rightarrow x=\frac{kh-16kt^2}{16t^2}$. And $\frac{dx}{dt}=v(t)=\frac{16t^2(-32kt)-(kh-16kt^2)(32t)}{(16t^2)^2}$ and $v(\frac{1}{2})=-kh$.



5. $\boxed{25{,}000}$ $\frac{dy}{dt}=1000e^{-t/20}(1-\frac{t}{20})$. At $t=0, y=25000$ and at $t=20, y=32358$ and at $t=100, y=25674$. therefore the minimum is at $y=25{,}000$.

6. $\boxed{\frac{50}{3}}$ Splitting the region into a rectangle and another region gives Area = $6+\int_0^4\frac{5x^2+16}{16}dx=6+\frac{32}{3}=\frac{50}{3}$.

7. $\boxed{-\sqrt{2}\sin\theta}$ Note that $\sqrt{1-\cos 2\theta}=\sqrt{2\sin^2\theta}=\sqrt{2}\sin\theta$. So, now $r=\frac{\sqrt{2}\sin\theta}{\tan\theta}=\sqrt{2}\cos\theta\Rightarrow\frac{dr}{d\theta}=-\sqrt{2}\sin\theta$.

8. $\boxed{e^{-x}+\sin x}$ Using patterns we get, $(-1)^{100}e^{-x}+\sin x=e^{-x}+\sin x$.

9. $\boxed{k=5}$ $R_x=\pi\int_0^k(kx-x^2)dx=\frac{\pi k^5}{30}$ and $R_y=2\pi\int_0^k x(kx-x^2)dx=\frac{\pi k^4}{6}$. $R_x=R_y$ at k = 5.

10. $\boxed{(0,0)}$ $f'(x)=\frac{4}{3}x^{\frac{1}{3}}+\frac{4}{3}x^{\frac{-2}{3}}$. As $x\to 0, f'(x)\to\infty$. Therefore, there is a vertical tangent at (0, 0).

11. $\boxed{4x-3y=43}$ $x=7$ implies $y=-5$ or $y=1$. Also, $2x+2yy'-6+4y'=0 \Rightarrow y'=\dfrac{3-x}{y+2}$ and at (7, -5) we get the answer.

12. $\boxed{90\text{ in/sec}}$ $a=\dfrac{dv}{dt}=6t \Rightarrow dv=6tdt \Rightarrow v=3t^2+c=\dfrac{ds}{dt} \Rightarrow ds=(3t^2+c)dt \Rightarrow s=t^3+ct+k$. So, $s(1)=10=1+c+k$ and $s(2)=80=8+2c+k$. And, $c=63$ & $k=-54$. This yields $v=3t^2+63$ and $v(3)=90$.

13. $\boxed{-1\le x<5}$ Using the Ratio Test, we get $R=\lim_{n\to\infty}\left|\dfrac{\dfrac{(x-2)^{n+1}}{(n+1)3^{n+1}}}{\dfrac{(x-2)^n}{n3^n}}\right|=\left|\dfrac{x-2}{3}\right|$. This converges if $\left|\dfrac{x-2}{3}\right|<1$ or $-1<x<5$. Checking endpoints: At x = 5, it diverges (harmonic series) and at x = -1, it converges (alternating harmonic series).

14. $\boxed{2}$ $W=\int_1^4 x^{-1/2}dx=2$ ft-lbs.

15. $\boxed{x^x(1+\ln x)}$ Taking the natural log of both sides gives $\ln y=\ln(x^x)\Rightarrow x\ln x$. Differentiating both sides gives $\dfrac{1}{y}y'=x\bullet\dfrac{1}{x}+\ln x=1+\ln x$. Multiplying by y and substituting back in for y gives the answer.