**5.** $\frac{d}{dx}(x^2y+xy^2)=\frac{d}{dx}(3x) \Rightarrow (x^2y'+y\cdot 2x)+(x\cdot 2yy'+y^2\cdot 1)=3 \Rightarrow x^2y'+2xyy'=3-2xy-y^2 \Rightarrow$

$y'(x^2+2xy)=3-2xy-y^2 \Rightarrow y'=\frac{3-2xy-y^2}{x^2+2xy}$

**13.** $\sqrt{xy}=1+x^2y \Rightarrow \frac{1}{2}(xy)^{-1/2}(xy'+y\cdot 1)=0+x^2y'+y\cdot 2x \Rightarrow \frac{x}{2\sqrt{xy}}y'+\frac{y}{2\sqrt{xy}}=x^2y'+2xy \Rightarrow$

$y'\left(\frac{x}{2\sqrt{xy}}-x^2\right)=2xy-\frac{y}{2\sqrt{xy}} \Rightarrow y'\left(\frac{x-2x^2\sqrt{xy}}{2\sqrt{xy}}\right)=\frac{4xy\sqrt{xy}-y}{2\sqrt{xy}} \Rightarrow y'=\frac{4xy\sqrt{xy}-y}{x-2x^2\sqrt{xy}}$

**14.** $\sin x+\cos y=\sin x\cos y \Rightarrow \cos x-\sin y\cdot y'=\sin x(-\sin y\cdot y')+\cos y\cos x \Rightarrow$

$(\sin x\sin y-\sin y)y'=\cos x\cos y-\cos x \Rightarrow y'=\frac{\cos x(\cos y-1)}{\sin y(\sin x-1)}$

**17.** $x^2+xy+y^2=3 \Rightarrow 2x+xy'+y\cdot 1+2yy'=0 \Rightarrow xy'+2yy'=-2x-y \Rightarrow y'(x+2y)=-2x-y \Rightarrow$

$y'=\frac{-2x-y}{x+2y}$. When $x=1$ and $y=1$, we have $y'=\frac{-2-1}{1+2\cdot 1}=\frac{-3}{3}=-1$, so an equation of the tangent line is

$y-1=-1(x-1)$ or $y=-x+2$.

**23.** $9x^2+y^2=9 \Rightarrow 18x+2yy'=0 \Rightarrow 2yy'=-18x \Rightarrow y'=-9x/y \Rightarrow$

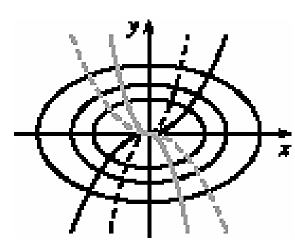
$y''=-9\left(\frac{y\cdot 1-x\cdot y'}{y^2}\right)=-9\left(\frac{y-x(-9x/y)}{y^2}\right)=-9\cdot\frac{y^2+9x^2}{y^3}=-9\cdot\frac{9}{y^3}$ [since $x$ and $y$ must satisfy the original equation, $9x^2+y^2=9$]. Thus, $y''=-81/y^3$.

**32.** $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1 \Rightarrow \frac{2x}{a^2}+\frac{2yy'}{b^2}=0 \Rightarrow y'=-\frac{b^2x}{a^2y} \Rightarrow$ an equation of the tangent line at $(x_0,y_0)$ is

$y-y_0=\frac{-b^2x_0}{a^2y_0}(x-x_0)$. Multiplying both sides by $\frac{y_0}{b^2}$ gives $\frac{y_0y}{b^2}-\frac{y_0^2}{b^2}=-\frac{x_0x}{a^2}+\frac{x_0^2}{a^2}$. Since $(x_0,y_0)$ lies on the ellipse, we have $\frac{x_0x}{a^2}+\frac{y_0y}{b^2}=\frac{x_0^2}{a^2}+\frac{y_0^2}{b^2}=1$.

**36.** $y=ax^3 \Rightarrow y'=3ax^2$ and $x^2+3y^2=b \Rightarrow 2x+6yy'=0 \Rightarrow$

$3yy'=-x \Rightarrow y'=-\frac{x}{3(y)}=-\frac{x}{3(ax^3)}=-\frac{1}{3ax^2}$, so the curves are orthogonal.



**38.** $\sqrt{x}+\sqrt{y}=\sqrt{c} \quad \Rightarrow \quad \dfrac{1}{2\sqrt{x}}+\dfrac{y'}{2\sqrt{y}}=0 \quad \Rightarrow \quad y'=-\dfrac{\sqrt{y}}{\sqrt{x}} \quad \Rightarrow$ an equation of the tangent line at $(x_0, y_0)$ is $y-y_0=-\dfrac{\sqrt{y_0}}{\sqrt{x_0}}(x-x_0)$. Now $x=0 \quad \Rightarrow \quad y=y_0-\dfrac{\sqrt{y_0}}{\sqrt{x_0}}(-x_0)=y_0+\sqrt{x_0}\sqrt{y_0}$, so the $y$-intercept is $y_0+\sqrt{x_0}\sqrt{y_0}$. And $y=0 \quad \Rightarrow \quad -y_0=-\dfrac{\sqrt{y_0}}{\sqrt{x_0}}(x-x_0) \quad \Rightarrow \quad x-x_0=\dfrac{y_0\sqrt{x_0}}{\sqrt{y_0}} \quad \Rightarrow$ $x=x_0+\sqrt{x_0}\sqrt{y_0}$, so the $x$-intercept is $x_0+\sqrt{x_0}\sqrt{y_0}$. The sum of the intercepts is

$$\left(y_0+\sqrt{x_0}\sqrt{y_0}\right)+\left(x_0+\sqrt{x_0}\sqrt{y_0}\right)=x_0+2\sqrt{x_0}\sqrt{y_0}+y_0=\left(\sqrt{x_0}+\sqrt{y_0}\right)^2=\left(\sqrt{c}\right)^2=c.$$