Find $\frac{\partial}{\partial y}$ of the following (remember, x acts like a constant):

1) $e^{xx}y^2$
2) $y^2 e^{x^2 y^3}$
3) $\frac{y^2}{\ln y}$
4) $\cos^3\left(xy^2\right)$
5) $\tan^{-1}(xy^2)$
6) $\sin^3 y$
7) $\sin\left(y^3\right)$
8) $\ln\sqrt{x^2+y^2}$

Answers
(not necessarily simplified):

1) $\frac{\partial}{\partial y}\left(e^{xx}y^2\right)=e^{xx}(2y)$

e^{xx} acts like a constant multiplier for y^2

2) $\frac{\partial}{\partial y}\left(y^2e^{x^2y^3}\right)=(2y)e^{x^2y^3}+y^2\left(e^{x^2y^3}\bullet\frac{\partial}{\partial y}\left(x^2y^3\right)\right)$

$$=(2y)e^{x^2y^3}+y^2\left(e^{x^2y^3}\bullet x^2\left(3y^2\right)\right)$$

Product rule and chain rule

3) $\frac{\partial}{\partial y}\left(\frac{y^2}{\ln y}\right) = \frac{(\ln y)(2y) - \left(y^2\right)\left(\frac{1}{y}\right)}{\left(\ln y\right)^2}$

Quotient rule: $\frac{\text{Lo}\bullet\text{D(Hi)-Hi}\bullet\text{D(Lo)}}{\text{Square of below}}$

As in 2), write $\frac{\partial}{\partial \text{y}}$ if you need the chain rule.

4) $\frac{\partial}{\partial y}\left(\cos^3\left(xy^2\right)\right) = \frac{\partial}{\partial y}\left[\left(\cos\left(xy^2\right)\right)^3\right]$ (Clearer notation)

$$= 3\left(\cos\left(xy^2\right)\right)^2 \bullet \frac{\partial}{\partial y}\left(\cos\left(xy^2\right)\right)$$

$$= 3\left(\cos\left(xy^2\right)\right)^2 \bullet \left(-\sin\left(xy^2\right) \bullet \frac{\partial}{\partial y}\left(xy^2\right)\right)$$

$$= 3\left(\cos\left(xy^2\right)\right)^2 \bullet \left(-\sin\left(xy^2\right) \bullet x\left(2y\right)\right)$$

Trig powers, power rule, chain rule (twice!)

5) $\frac{\partial}{\partial y}\left(\tan^{-1}\left(xy^2\right)\right)=\frac{1}{1+\left(xy^2\right)^2}\bullet\frac{\partial}{\partial y}\left(xy^2\right)$

$$=\frac{1}{1+\left(xy^2\right)^2}\bullet x\left(2y\right)$$

Rule: $\frac{\partial}{\partial y}\tan^{-1}\left(blah\right)=\frac{1}{1+blah^2}\bullet\frac{\partial}{\partial y}\left(blah\right)$

6) $\frac{\partial}{\partial y}\left(\sin^3 y\right)=\left(\sin y\right)^3$ (Clearer notation)

$$=3(\sin y)^2\bullet\frac{\partial}{\partial y}\left(\sin y\right)$$

$$=3(\sin y)^2\bullet\cos y$$

7) $\frac{\partial}{\partial y}\left(\sin\left(y^3\right)\right)=\cos\left(y^3\right)\bullet\frac{\partial}{\partial y}\left(y^3\right)$

$$=\cos\left(y^3\right)\bullet 3y^2$$

As opposed to 6), we don@t need the power rule here until the end.

8) $$\frac{\partial}{\partial y}\left(\ln\sqrt{x^2+y^2}\right)=\frac{1}{\sqrt{x^2+y^2}}\bullet\frac{\partial}{\partial y}\left(\sqrt{x^2+y^2}\right)$$

$$=\frac{1}{\sqrt{x^2+y^2}}\bullet\frac{\partial}{\partial y}\left[\left(x^2+y^2\right)^{1/2}\right]$$

$$=\frac{1}{\sqrt{x^2+y^2}}\bullet\frac{1}{2}\left(x^2+y^2\right)^{-1/2}\bullet\frac{\partial}{\partial y}\left(x^2+y^2\right)$$

$$=\frac{1}{\sqrt{x^2+y^2}}\bullet\frac{1}{2}\left(x^2+y^2\right)^{-1/2}\bullet 2y$$

Rule: $\frac{\partial}{\partial y}\ln(blah)=\frac{1}{blah}\bullet\frac{\partial}{\partial y}\left(blah\right)$

Roots as powers, power rule, chain rule