Worksheet 10
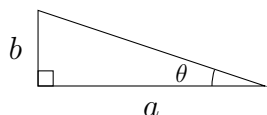
12 November 2020

Recall the following functions and their derivatives:

$f(x)$	$\sin(x)$	$\cos(x)$	$\tan(x)$	$\arcsin(x)$	$\arccos(x)$	$\arctan(x)$
$f'(x)$	$\cos(x)$	$-\sin(x)$	$\sec^2(x)$	$\frac{1}{\sqrt{1-x^2}}$	$\frac{-1}{\sqrt{1-x^2}}$	$\frac{1}{1+x^2}$

1. **Warm up:** Recall the geometric formulas for right-angled triangles.

   (a) For the triangle below, what are the values of $\sin(\theta)$, $\cos(\theta)$, $\tan(\theta)$?

   (b) For the triangle below, you are given that $\arcsin(c) = \alpha$. What are the values of $\sec(\alpha)$ and $\cot(\alpha)$?

2. Compute the derivative with respect to x of the following functions.

   (a) x^x

   (b) $(x^x)^x$

   (c) $x^{(x^x)}$

   (d) $(x^x)^{(x^x)}$

3. Recall the following identities:

   - $\tan^2(x) + 1 = \sec^2(x)$
   - $1 + \cot^2(x) = \csc^2(x)$
   - $\csc(x) = \frac{1}{\sin(x)}$
   - $\sec(x) = \frac{1}{\cos(x)}$

   Using these, complete the table of derivatives below.

$f(x)$	$\csc(x)$	$\sec(x)$	$\cot(x)$	$\operatorname{arccsc}(x)$	$\operatorname{arcsec}(x)$	$\operatorname{arccot}(x)$
$f'(x)$						

4. Differentiate the following functions, with respect to z.

   (a) $\sqrt{z+2}\ln(z^3 + 2z)$

   (b) $\ln(\arctan(3^z)/\pi) + 22$

   (c) $2\cos(z)^{z+1}$

   (d) $10z^2 + (e^{z+3}/e^3)^{z^2}$