MATH1060: Midterm 2 Practice Problems

The following are practice problems for the first exam.

1. Evaluate the following expressions:
   (a) $\arcsin \frac{\sqrt{3}}{2} = \frac{\pi}{3}$
   (b) $\cos^{-1}(0) = \frac{\pi}{2}$
   (c) $\sin^{-1} \frac{-1}{2} = \frac{-\pi}{6}$
   (d) $\arctan \sqrt{3} = \frac{\pi}{3}$
   (e) $\arccos \frac{-\sqrt{2}}{2} = \frac{3\pi}{4}$
   (f) $\tan^{-1}(-1) = \frac{-\pi}{4}$
2. Sketch the graph of the following functions:
   (a) $y = \tan\left(\frac{x}{2}\right)$
   (b) $y = \csc(x)$
   (c) $y = \arctan(x)$
   (d) $y = \sin^{-1}(x)$

   Use a calculator
3. The sun is 20° above the horizon. If Mike is 6 feet tall, how long is his shadow? Answer: $s = \frac{6}{\tan 20°}$
4. An airplane is 200 miles north and 125 miles west of the airport. The pilot wants to fly directly to the airport. What bearing should be taken? Answer: $S\theta E$ where $\theta = \tan^{-1}\left(\frac{125}{200}\right)$
5. Determine the angle between the diagonal of a cube and its edge. (This is Exercise 44 from §4.8 in the textbook). Answer: $\theta = \tan^{-1}(\sqrt{2})$
6. A car is moving at 60 miles per hour. Its wheel is rotating at 2 revolutions per second. What is the radius of its tire? Answer: 7.002 feet
7. A satellite in a circular orbit 1250 km above earth makes one complete revolution every 110 minutes. If we assume that Earth is a sphere of radius 6378 km, what is the linear speed of the satellite? Answer: 430 kilometers per minute
8. Identify each of the following expressions as one of the standard trigonometric functions:
   (a) $\sec\beta \csc\beta - \cot\beta$ Answer: $\tan\beta$

(b) $\dfrac{\sin\gamma}{1-\cos^2\gamma}$ Answer: $\csc\gamma$

9. Simplify the following expressions:

   (a) $\sec^4\alpha - \tan^4\alpha$ Answer: $1 + 2\tan^2\alpha$

   (b) $1 - 2\cos^2\delta + \cos^4\delta$ Answer: $\sin^4\delta$

   (c) $\sin^2\zeta + 3\cos\zeta + 3$ Answer: $-(\cos\zeta - 4)(\cos\zeta + 1)$

   (d) $\sin\epsilon\tan\epsilon + \cos\epsilon$ Answer: $\sec\epsilon$

   (e) $\sin\eta(\csc\eta - \sin\eta)$ Answer: $\cos^2\eta$

   (f) $\tan\iota - \dfrac{\sec^2\iota}{\tan\iota}$ Answer: $-\cot\iota$

10. Rewrite the following expression so it is *not* in fractional form:

$$\frac{6}{\tan\kappa + \sec\kappa}$$

Answer: $-6(\tan\kappa - \sec\kappa$

11. Use the trigonometric substitution $3x = 5\tan\lambda$ to simplify the expression $\sqrt{9x^2+25}$ Answer: $5\sec\lambda$

12. Simplify the expression $\ln|\cos\mu| + \ln(1+\tan^2\mu)$

13. Verify the following identities:

   (a) $\cos^2\alpha - \sin^2\alpha = 1 - 2\sin^2\alpha$

   (b) $\dfrac{1}{\tan\gamma} + \dfrac{1}{\cot\gamma} = \tan\gamma + \cot\gamma$

   (c) $\cos^2\theta + \cos^2(\frac{\pi}{2} - \theta) = 1$

   (d) $\tan(\sin^{-1}x) = \dfrac{x}{\sqrt{1-x^2}}$