Trigonometry — Joysheet 1
MAT 145, Spring 2017 — D. Ivanšić

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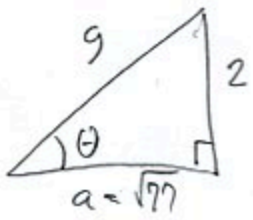
Covers: 6.1, 6.2 *Show all your work!*

1. (8pts) If θ is an acute angle, find the values of all the trigonometric functions of θ given that $\sin\theta = \frac{2}{9}$.



$a^2 + 2^2 = 9^2$

$a^2 + 4 = 81$

$a^2 = 77$

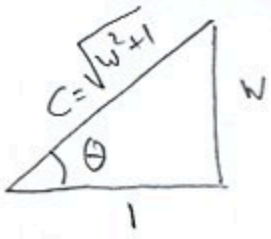
$a = \sqrt{77}$

$\sin\theta = \frac{2}{9}$ $\quad \csc\theta = \frac{9}{2}$

$\cos\theta = \frac{\sqrt{77}}{9}$ $\quad \sec\theta = \frac{9}{\sqrt{77}} = \frac{9\sqrt{77}}{77}$

$\tan\theta = \frac{2}{\sqrt{77}} = \frac{2\sqrt{77}}{77}$ $\quad \cot\theta = \frac{\sqrt{77}}{2}$

2. (8pts) If θ is an acute angle, find the values of all the trigonometric functions of θ given that $\tan\theta = w$, where w is some number.



$c^2 = w^2 + 1^2$

$c = \sqrt{w^2+1}$

$\sin\theta = \frac{w}{\sqrt{w^2+1}}$ $\quad \csc\theta = \frac{\sqrt{w^2+1}}{w}$

$\cos\theta = \frac{1}{\sqrt{w^2+1}}$ $\quad \sec\theta = \sqrt{w^2+1}$

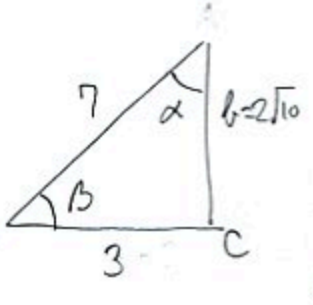
$\tan\theta = w = \frac{w}{1}$ $\quad \cot\theta = \frac{1}{w}$

3. (10pts) Given that $\sin 23° = a$, $\cos 34° = b$, $\sec 15° = c$ and $\cot 89° = d$, use basic and cofunction identities to express the following quantities using a, b, c and d.

$\sin 56° = \cos 34° = b$ $\quad \csc 56° = \frac{1}{\sin 56°} = \frac{1}{b}$ $\quad \tan 1° = \cot 89° = d$ $\quad \tan 89° = \frac{1}{\cot 89°} = \frac{1}{d}$

$\csc 75° = \sec 15° = c$ $\quad \cos 15° = \frac{1}{\sec 15°} = \frac{1}{c}$ $\quad \csc 23° = \frac{1}{\sin 23°} = \frac{1}{a}$ $\quad \sec 67° = \csc 23° = \frac{1}{a}$

4. (10pts) Solve the right triangle (that is, find all sides and angles), if $a = 3$, $c = 7$.



$3^2 + b^2 = 7^2$

$9 + b^2 = 49$

$b^2 = 40$

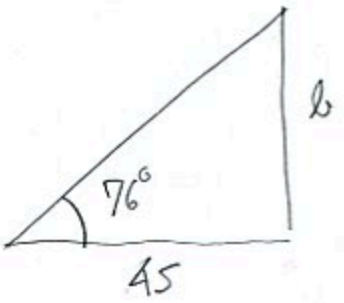
$b = \sqrt{40} = 2\sqrt{10}$

$\cos\beta = \frac{3}{7}$

$\beta = \cos^{-1}\frac{3}{7} = 64.623066^\circ$

$\alpha = 90^\circ - \beta = 25.376934^\circ$

5. (10pts) You are standing 45ft from a building and measure the angle of elevation to the top of the building to be 76°. How tall is the building?

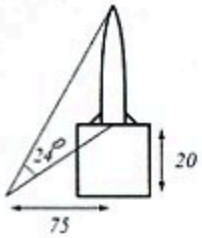


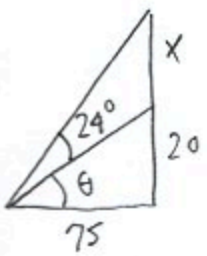
$\frac{b}{45} = \tan 76^\circ$

$b = 45\tan 76^\circ$

$b = 180.485142$

6. (14pts) From a point on the ground 75 meters away from the launch pad, you observe a rocket and note it subtends an angle of 24°. If the launch pad is 20 meters tall, how tall is the rocket?





$\tan\theta = \frac{20}{75} = \frac{4}{15}$

$\theta = \tan^{-1}\frac{4}{15} = 14.931417^\circ$

So $\theta + 24^\circ = 38.931417^\circ$

$\tan(\theta + 24^\circ) = \frac{x+20}{75}$

$75\tan(\theta + 24^\circ) = x + 20$

$x = 75\tan(38.931417^\circ) - 20$

$x = 40.585302$

About 40.6 ft tall