NO CALCULATOR

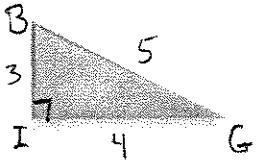
SECTION
ROW
SEAT
(from aisle)

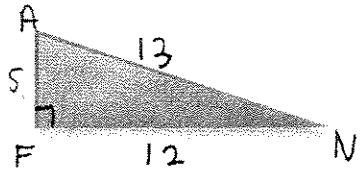
Name Solutions

MATH 1060 -- EXAM 3 Identities and applications

A calclulator is necessary only on the 3rd and 4th pages.

Show work. Simplify answers.




1. *(13 pts)*

a. sin 2B

$\sin 2B = 2\sin B\cos B$

$= 2\left(\frac{4}{5}\right)\left(\frac{3}{5}\right) = \frac{24}{25}$

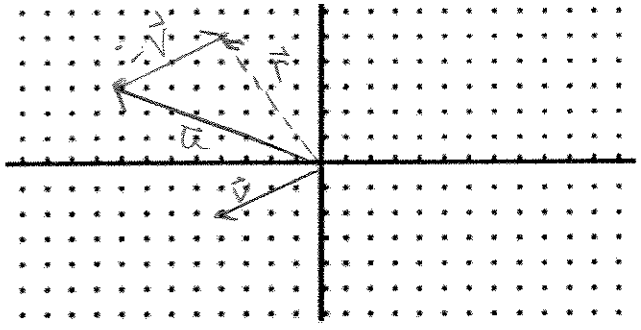
b. tan (A - B)

$\frac{\tan A - \tan B}{1 + \tan A \tan B}$

$\frac{\frac{12}{5} - \frac{4}{3}}{1 + \frac{12}{5}\cdot\frac{4}{3}} = \left(\frac{\frac{36-20}{15}}{1 + \frac{48}{15}}\right)\frac{15}{15} = \frac{16}{15+48} = \frac{16}{63}$

2. **VECTORS** *(12 pts)*

Draw these vectors on this graph.




$\boldsymbol{u} = \langle -8, 3 \rangle$

$\boldsymbol{v} = \langle -4, -2 \rangle$

a) State in component form : $\boldsymbol{u} - \boldsymbol{v}$ $= \langle -8-(-4),\ 3-(-2) \rangle$

$\langle -4, 5 \rangle$

b) Show the subtraction process for $\boldsymbol{u} - \boldsymbol{v}$ on the graph and label the resultant, $\boldsymbol{r}$.

c) What is the magnitude of $\boldsymbol{r}$? $\|r\| = \sqrt{16+25} = \sqrt{41}$

d) If the reference angle of $\boldsymbol{r}$ is 51°, what is the direction angle of $\boldsymbol{r}$?

$180° - 51° = 129°$

NO CALCULATOR

3. Find the exact value of cos 105° in **two ways**; Simplify the result. *12 pts*

a) use a sum/difference formula

$\cos(45° + 60°)$

$= \cos 45° \cos 60° - \sin 45° \sin 60°$

$\frac{\sqrt{2}}{2} \cdot \frac{1}{2} - \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{3}}{2}$

$= \frac{\sqrt{2} - \sqrt{6}}{4}$

b) use a half angle formula.

$\cos\frac{210°}{2} = \pm\sqrt{\frac{1 + \cos 210°}{2}}$

$105°$ 2nd quadrant so negative

$-\sqrt{\frac{1 + (-\frac{\sqrt{3}}{2})}{2}} \cdot \frac{2}{2} = -\sqrt{\frac{2 - \sqrt{3}}{4}}$

$= -\frac{\sqrt{2 - \sqrt{3}}}{2}$

4. If the terminal side of $\theta$ passes through the point (2,5) determine the exact values:

*13 pts*

Simplify all answers. Label and underline each.

$\sin\theta$,

$h = \sqrt{4 + 25}$

$= \sqrt{29}$

$\sin\theta = \frac{5}{\sqrt{29}}$

$\tan(\frac{\theta}{2})$.

$= \frac{1 - \cos\theta}{\sin\theta}$

$= \left(\frac{1 - \frac{2}{\sqrt{29}}}{\frac{5}{\sqrt{29}}}\right)\left(\frac{\sqrt{29}}{\sqrt{29}}\right)$

$= \frac{\sqrt{29} - 2}{5}$

## USE CALCULATOR

On these two pages, you may use your calculator. Show a reasonable amount of work. Sketch, show the set-up. Be aware of whether your calculator is in radians or degrees for each problem.

5. Use a calculator to determine all solutions (in radians 0.01) to this equation on the interval $[0,2\pi)$.

$(5\sin x - 2)(\cos x + 1) = 0$

$\sin x = \frac{2}{5}$ $\quad \cos x = -1$

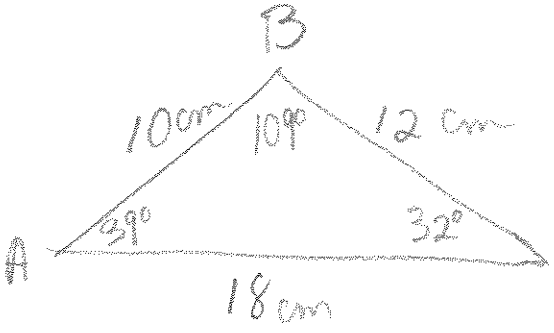
$\sin^{-1}\left(\frac{2}{5}\right) \approx .41$ $\quad x = \pi$

Also an obtuse angle

$\pi - .41 \approx 2.73$

$x = .41,\ 2.73,\ \pi$

6. If the three sides of a triangle are 18 cm, 10 cm and 12 cm, determine the three angles in degrees, rounded to the nearest whole degree.




Largest angle

$18^2 = 10^2 + 12^2 - 2(10)(12)\cos B$

$\cos B = \frac{18^2 - 10^2 - 12^2}{240} = \frac{-80}{240} = -\frac{1}{3}$

$B = \cos^{-1}\frac{-1}{3} = 109°$

$\frac{\sin A}{12} = \frac{\sin 109°}{18}$

$A = \sin^{-1}\left(\frac{12\sin 109°}{18}\right)$

$= 39°$

$C = 180° - 109° - 39° = 32°$

angles are $109°, 39°, 32°$

USE CALCULATOR

7. VECTORS *14 pts*

a. Determine the angle (degrees) between these two vectors:

$\boldsymbol{u} = \langle -5,8 \rangle$ and $\boldsymbol{v} = \langle 4,-10 \rangle$

$\cos\theta = \frac{-20-80}{\sqrt{89}\cdot\sqrt{116}}$

$\theta = \cos^{-1}\left(\frac{-100}{\sqrt{89}\cdot 116}\right) = 170^\circ$

b. Determine the resultant magnitude and direction angle (in degrees) when the two vectors in part *a* are added together.

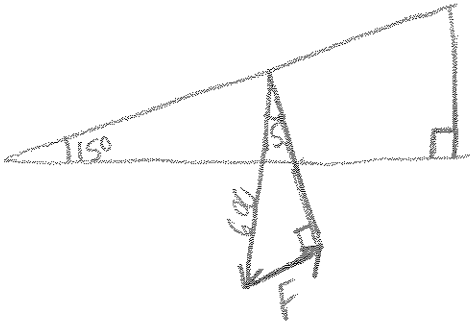
$\boldsymbol{u} + \boldsymbol{v} = \langle -1,-2 \rangle$

$\|\text{rll}\| = \sqrt{1+4} = \sqrt{5}$

rfa $\theta' = \arctan\left(\frac{-2}{-1}\right) = 63^\circ$

$\theta = 180^\circ + 63^\circ = 243^\circ$

8. FORCE *11 pts.* What force is required to keep a 600 lb motorcycle from rolling down a 15º ramp? You must sketch the situation and properly label the forces.




$\frac{F}{600} = \sin 15^\circ$

$F = 600 \sin 15^\circ \approx 155\text{ lb}$