Dawson College: **Introduction to Applied Mathematics**: 201-912-DW-S1: Fall 2011

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Test 1

This test is graded out of 45 marks. No books, notes, graphing calculators or cell phones are allowed. You must show all your work, the correct answer is worth 1 mark the remaining marks are given for the work. If you need more space for your answer use the back of the page.

Question 1. *(4 marks)* Simplify the following expressing your final answer with positive exponents only:

$$\left(\frac{-2x^2y^{-3}z^{11}}{y^2z^{-3}}\right)^{-2}\frac{3y^{-2}}{-2z^0} = \left(\frac{y^2z^{-3}}{-2x^2y^{-3}z^{11}}\right)^{2}\frac{3y^{-2}}{-2}$$

$$= \left(\frac{y^4z^{-6}}{4x^4y^{-6}z^{22}}\right)\frac{3y^{-2}}{-2}$$

$$= \frac{3}{-8}\,\frac{y^4y^6}{z^6y^2x^4z^{22}}$$

$$= \frac{-3}{8}\cdot\frac{y^8}{x^4z^{28}}$$

Question 2. *(4 marks)* Solve for . Express your answer as a fraction:

$$\frac{4x-1}{3} = \frac{x-3(2-x)}{2}$$

$$2(4x-1) = 3(x-3(2-x))$$

$$8x-2 = 3x-9(2-x)$$

$$8x-2 = 3x-18+9x$$

$$16 = 4x$$

$$4 = x$$

Question 3. *(4 marks)* Solve for y:

$$\frac{1}{x} = \frac{2}{y} + \frac{3}{z}$$

$$\frac{1}{x} = \frac{2z + 3y}{yz}$$

$$yz = x(2z + 3y)$$

$$yz = 2xz + 3xy$$

$$-2xz = 3xy - yz$$

$$-2xz = y(3x - z)$$

$$y = \frac{-2xz}{(3x - z)}$$

Question 4. *(7 marks)* Find the equation of the line passing throught the point $(3,3)$ and perpendicular to the line $3 = 6x + 2y$. Sketch the graph of both lines.

Lets find the slope of the first line:

$$2y = 3 - 6x$$

$$y = \frac{3}{2} - 3x$$

$\therefore m_1 = -3$

$\therefore$ slope of perpendicular line $m_2 = \frac{1}{3}$

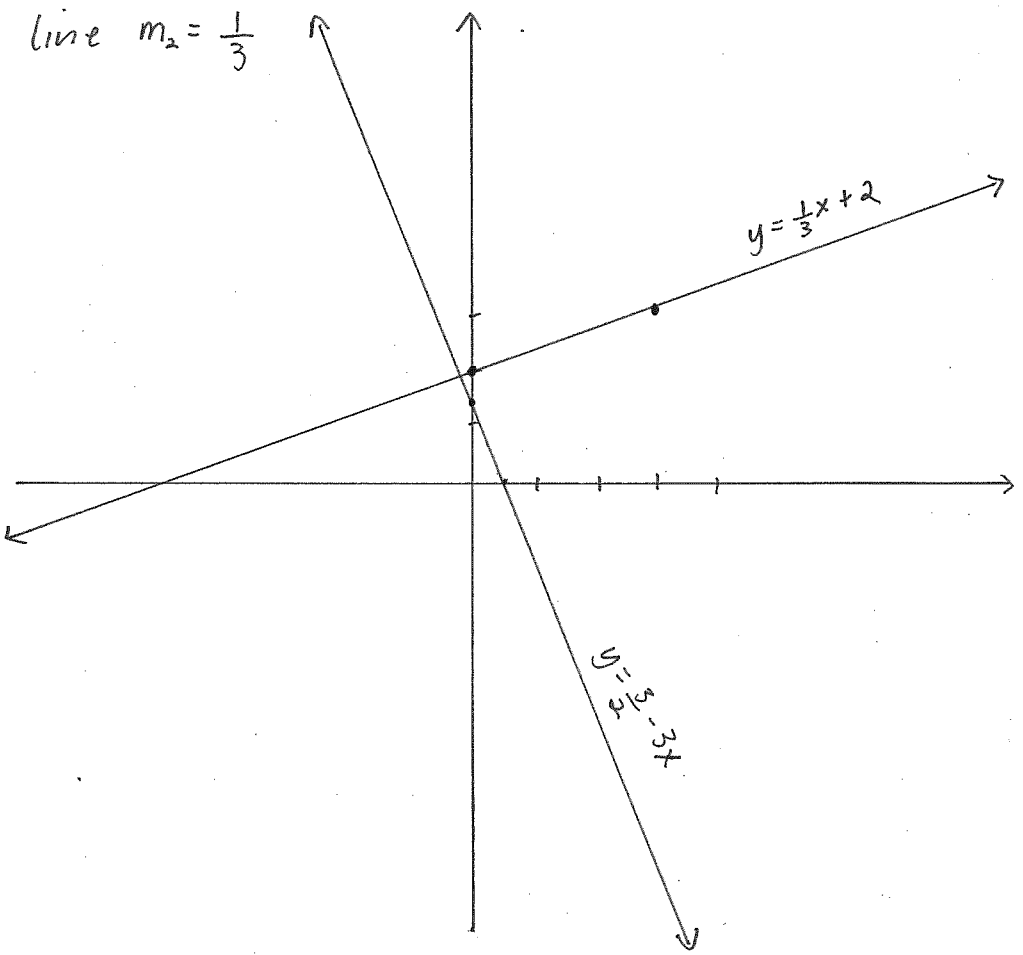
$$y = m_2x + b$$

$$y = \frac{1}{3}x + b$$

$$3 = \frac{1}{3} \cdot 3 + b$$

$$2 = b$$

$\therefore y = \frac{1}{3}x + 2$

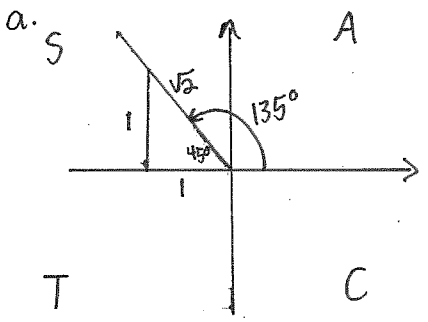


Question 5. *(2 marks each)* Find the exact values of the following (no decimals or rounding).

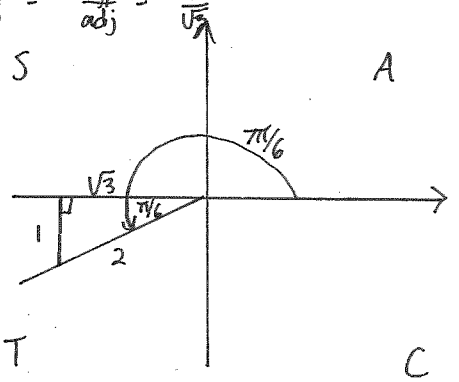
a. $\tan 135° =$ $\frac{opp}{adj} = -1$

b. $\sec \frac{7\pi}{6}$ $\quad \sec \frac{7\pi}{6} = \frac{hyp}{adj} = -\frac{2}{\sqrt{3}}$

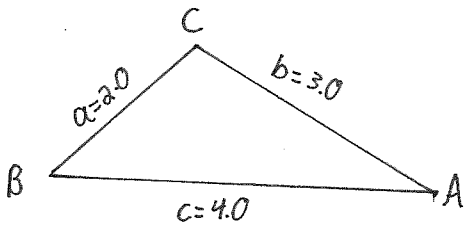
a.



b.



Question 6. *(4 marks)* Solve the triangle with sides $a = 2.0$, $b = 3.0$ and $c = 4.0$ *(round correctly)*



Lets determine the angle C.

$c^2 = a^2 + b^2 - 2ab\cos C$

$4.0^2 = 2.0^2 + 3.0^2 - 2(2.0)(3.0)\cos C$

$2(2.0)(3.0)\cos C = 2.0^2 + 3.0^2 - 4.0^2$

$\cos C = \frac{2.0^2 + 3.0^2 - 4.0^2}{2(2.0)(3.0)}$

$C = 100°$

Lets use Law of Sines to determine B.

$\frac{b}{\sin B} = \frac{c}{\sin C}$

$\sin B = \frac{b \sin C}{c}$

$\sin B = \frac{3.0 \sin 100.°}{4.0}$

$B = 48°$

$\therefore A = 180° - 100° - 48° = 32°$

Question 7. *(3 marks each) (use the correct number of signigicant figures)*

a. Convert $235N \cdot m$ (Newton metres) to $ft \cdot lbs$ (foot pounds).

b. Convert $33.3\frac{N}{dm^2}$ (Newton per square decimetres) to Pa (Pascals).

a. $235\ N \cdot m \left(\frac{1\ lb}{4.45\ N}\right)\left(\frac{100\ cm}{1\ m}\right)\left(\frac{1\ ft}{30.5\ cm}\right) = 173\ ft \cdot lbs$

b. $33.3\ \frac{N}{dm^2} = 33.3\ \frac{m}{s^2} \cdot Kg \cdot \frac{1}{dm^2}\left(\frac{10\ dm}{1\ m}\right)^2 = 3330\ \frac{Kg}{m \cdot s^2}$

Question 8. *(1 mark each)*

a. Find an angle between 0 and 2π that is coterminal with the angle $\frac{13\pi}{5}$. $\frac{13\pi}{5} - 2\pi = \frac{3\pi}{5}$

b. Convert $34°11'44''$ to decimal degree notation.

c. Convert $35.9832°$ to degree minute second notation.

d. Find the quadrant in which the terminal point determined by t lies, if $\sin(t) < 0$ and $sec(t) < 0$.

e. Convert $200°$ in radians.

f. Convert $\frac{4\pi}{8}$ in degrees.

g. Are $197°$ and $-377°$ co-terminal angles.

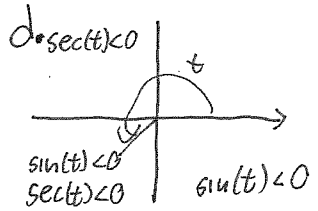
a. $\frac{13\pi}{5} - 2\pi = \frac{3\pi}{5}$

b. $34°\,11'\,44'' = 34° + \frac{11}{60}' + \frac{44}{(60)^2}'' = 34.1956°$

c. $35° + \lfloor 60(0.9832) \rfloor' + \lfloor 60(60(0.9832) - \lfloor 60(0.9832) \rfloor) \rfloor''$

$= 35°\,58'\,59''$

d. $\sec(t) < 0$



$\therefore$ in 3rd quadrant

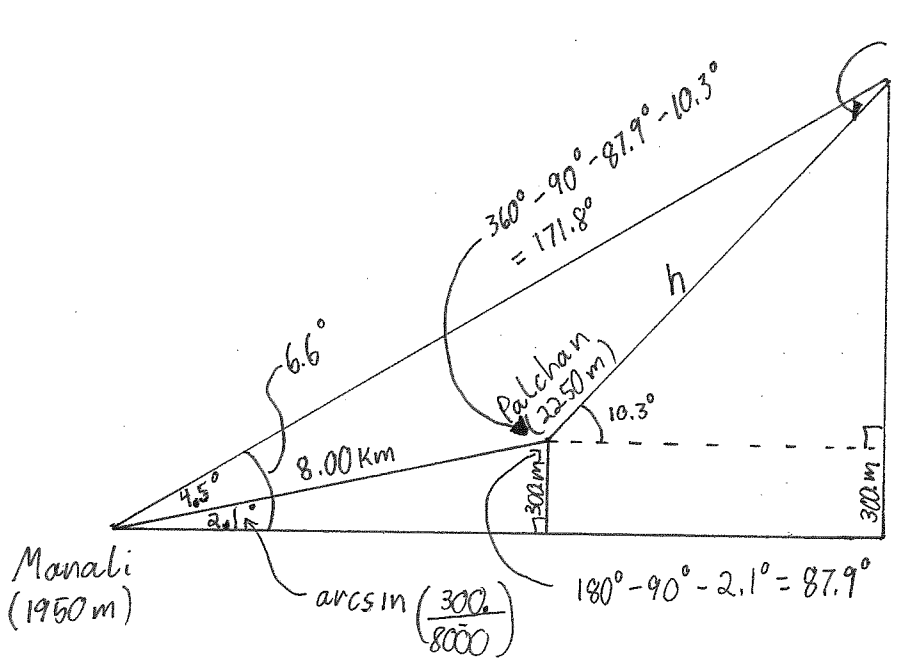
e. $200° \frac{\pi}{180} = \frac{10\pi}{9}$

f. $\frac{4\pi}{8}\ \frac{180}{\pi} = 90°$

g. $-377° + 360° + 360° = 343°$ or $-377° + 360° = -17°$ $\therefore$ no, not co-terminal.

Question 9. *(5 marks) (use the correct number of signigicant figures)*
In Yann's most recent trip, he must bike to the top of Rohtang Pass. Since Yann does not trust the author of his guide book, he wants to determine the height of the pass himself. Good thing he brought on his trip with him: a quadrant (to measure the *angle of elevation* from the horizon) and a GPS which displays his current elevation and total distance traveled.

The town of Manali is at an altitude of 1950*m*. Before leaving Manali Yann measures the angle of elevation to the top of Rohtang Pass which reads 6.6° . He bikes on a straight road with constant slope , 8.00km later he arrives in the town of Palchan at an altitude of 2250*m* where he again measures the angle of elevation to the top of Rohtang Pass which reads 10.3°. What is the height of Rohtang Pass?



Lets determine h by using the Law of Sines

$$\frac{h}{\sin 4.5^\circ} = \frac{8.00}{\sin 3.7^\circ}$$

$$h = \frac{8.00 \sin 4.5^\circ}{\sin 3.7^\circ}$$

$$= 9.73 \text{ Km}$$

$$\therefore \sin 10.3^\circ = \frac{O}{h}$$

$$O = h \sin 10.3^\circ$$

$$= 9.73 \sin 10.3^\circ$$

$$= 1740 \text{ m}$$

∴ the height of Rohtang Pass is $1950 + 300 + 1740$

$= 3990 \text{ m}$

Bonus Question. *(1 mark)*
Did Yann really bring a quadrant in his latest travels?

Nope