CMGT 350	Quiz #1	Fall 2020

SHOW ALL WORK FOR FULL CREDIT. DO YOUR OWN WORK. DO NOT SHARE SOLUTIONS OR ANSWERS WITH ANYONE IN THIS CLASS. CHEATERS WILL FAIL IMMEDIATELY.

Name: Solution

1. Newton's law of gravitation can be expressed in equation form as:

$$F = G\frac{m_1 m_2}{r^2}$$

If F is a force, m_1 and m_2 are masses, and r is a distance, determine the dimensions of G.

$$G = \frac{r^2 F}{m_1 m_2} = \frac{L^2 \frac{ML}{T^2}}{MM} = \frac{L^3}{MT^2}$$

2. What are the units of Force?

U.S.	lb
S.I.	N or kN

3. List the three properties required to completely define a force:

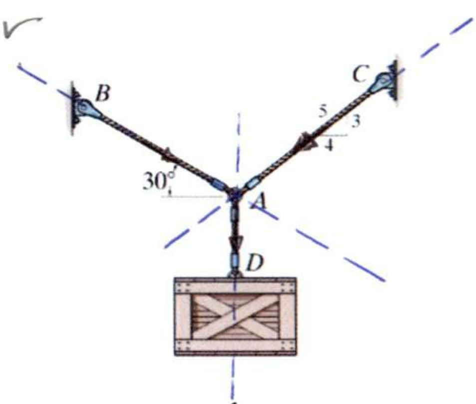
1.	magnitude
2.	Direction
2.	Point of Application

4. Find each angle measure to the nearest degree:

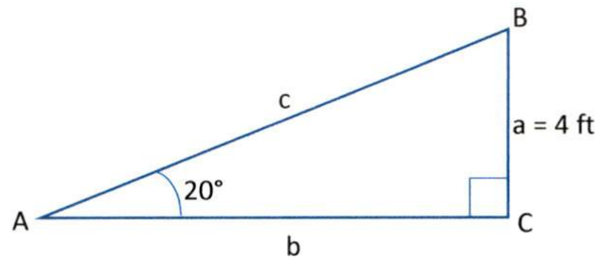
Tan Θ = 2.3812	Θ = 67°
Sin A = 0.7233	A = 46°
Cos B = 0.2953	B = 73°
Cos B = - 0.6820	B = 133°

5. What type of force system is shown below?

concurrent coplanar



6. You need to build a ramp with the dimensions shown. Solve for the lengths of sides b and c and find angle B.

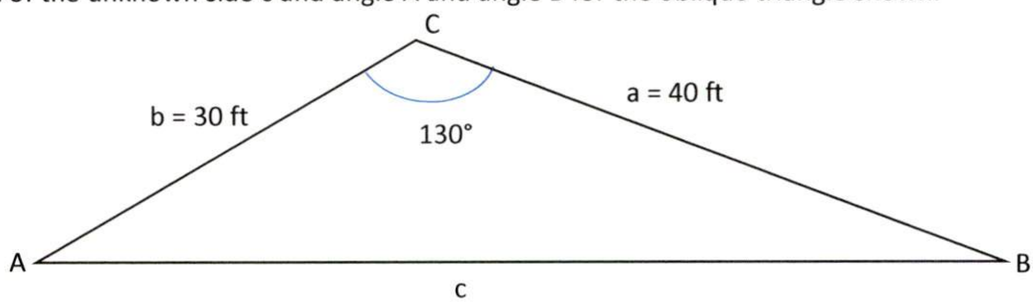


$$A + B = 90^\circ$$
$$B = 90^\circ - 20^\circ = \underline{\underline{70^\circ}}$$

$$\tan 20^\circ = \frac{4\,ft}{b} \Rightarrow b = \frac{4\,ft}{\tan 20^\circ} = \underline{\underline{11\,ft}}$$

$$c^2 = 4\,ft^2 + 11\,ft^2$$
$$c = \sqrt{137\,ft^2} = \underline{\underline{12\,ft}}$$

7. Determine the length of the unknown side c and angle A and angle B for the oblique triangle shown.

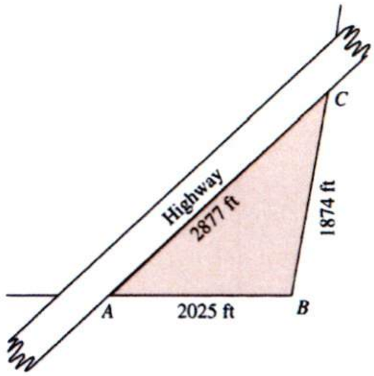


$$c^2 = 30\,ft^2 + 40\,ft^2 - 2(30\,ft)(40\,ft)\cos 130^\circ$$
$$c = \sqrt{2500\,ft^2 - -1543\,ft^2}$$
$$c = \sqrt{4043\,ft^2}$$
$$= \underline{\underline{64\,ft}}$$

$$\frac{\sin A}{40\,ft} = \frac{\sin 130^\circ}{64\,ft} \Rightarrow \sin A = \frac{40\,ft(\sin 130^\circ)}{64\,ft}$$
$$A = \sin^{-1}(0.510696295)$$
$$= \underline{\underline{31^\circ}}$$

$$B = 180^\circ - 130^\circ - 31^\circ$$
$$= \underline{\underline{19^\circ}}$$

8. A highway cuts a corner from a parcel of land. Find angles A, B, and C.



Solution.

$$2877\ ft^2 = 1874\ ft^2 + 2025\ ft^2 - 2(1874\ ft)(2025\ ft)\cos B$$

$$\cos B = \frac{7{,}612{,}501 - 8{,}277{,}129}{7{,}589{,}700} = -\frac{664{,}628}{7589700} = -0.08757$$

$$B = \cos^{-1}(-0.08757) = \underline{\underline{95°}}$$

$$\frac{\sin A}{1874\ ft} = \frac{\sin 95°}{2877\ ft}$$

$$A = \sin^{-1}(0.6489)$$

$$A = \underline{\underline{40.5°}}$$

$$C = 180° - 95° - 40.5° = \underline{\underline{44.5°}}$$

9. Solve for x

Tan (x + 24°) = 1.00

$$\tan^{-1}\tan(x+24°) = \tan^{-1}(1.00)$$

$$x + 24° = 45°$$

$$x = 45° - 24° = \underline{\underline{21°}}$$

10. Solve for x

$$12 + \frac{4(5x-15)}{5} = 15x + 22$$

$$5\left[12 + \frac{4(5x-15)}{5}\right] = (15x+22)(5)$$

$$60 + 20x - 60 = 75x + 110$$

$$-55x = 110$$

$$x = \frac{110}{-55} = \underline{\underline{-2}}$$

Check,

$$12 + \frac{4(-25)}{5} = -30 + 22$$

$$12 - 20 = -8$$

$$-8 = -8\ ✓$$

11. Solve the system of linear equations shown using the indicated method:

A. Method of Elimination by Substitution

$$4x - y = -18 \qquad (1)$$
$$X - 3y = -10 \qquad (2)$$

Solution.

solve (1) for x in terms of y

$$4x - y = -18$$
$$4x = -18 + y$$
$$x = \frac{-18 + y}{4} \qquad (3)$$

subst (3) into (2)

$$\frac{-18 + y}{4} - 3y = -10$$
$$-18 + y - 12y = -40$$
$$-11y = -40 + 18 = -22$$
$$y = \frac{-22}{-11} = \underline{\underline{2}}$$

subst. into (3)

$$x = \frac{-18 + 2}{4} = \frac{-16}{4} = \underline{\underline{-4}}$$

Check,

$$4(-4) - 2 = -18$$
$$-16 - 2 = -18$$
$$-18 = -18 \ \checkmark$$

12. Method of Elimination by Addition and Subtraction

$$4x - y = -18 \qquad (1)$$
$$4(X - 3y) = -10(4) \qquad (2)$$

Solution.

$$\begin{array}{rl} & 4x - y = -18 \\ - & 4x - 12y = -40 \\ \hline & 11y = 22 \\ & y = \underline{\underline{2}} \end{array}$$

From (1) $\quad 4x - 2 = -18$

$$x = \frac{-16}{4} = \underline{\underline{-4}}$$

Check

$$-4 - 3(2) = -10$$
$$-10 = -10 \checkmark$$

13. Cramer's Rule

$$4x - y = -18 \qquad (1)$$
$$X - 3y = -10 \qquad (2)$$

Solution.

$$\begin{bmatrix} 4 & -1 \\ 1 & -3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -18 \\ -10 \end{bmatrix}$$

$$D = \begin{vmatrix} 4 & -1 \\ 1 & -3 \end{vmatrix} = -12 - -1 = -11$$

$$D_x = \begin{vmatrix} -18 & -1 \\ -10 & -3 \end{vmatrix} = 54 - 10 = 44$$

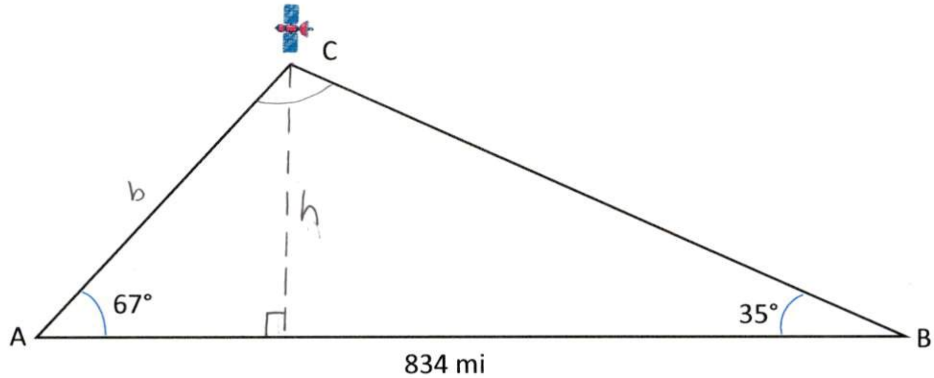
$$D_y = \begin{vmatrix} 4 & -18 \\ 1 & -10 \end{vmatrix} = -40 - -18 = -22$$

$$x = \frac{D_x}{D} = \frac{44}{-11} = \underline{\underline{-4}}$$

$$y = \frac{D_y}{D} = \frac{-22}{-11} = \underline{\underline{2}}$$

14. Two points A and B on level ground are 834 mi apart. The International Space Station (ISS) is observed over a line from A to B to have an elevation from point A of 67° and from point B of 35° as shown.

Determine the height of the ISS above the ground.



$C = 180° - 67° - 35° = 78°$

$$\frac{b}{\sin 35°} = \frac{834 mi}{\sin 78°}$$

$$b = \frac{\sin 35° (834 mi)}{\sin 78°} = 489 mi$$

$$\sin 67° = \frac{h}{489 mi}$$

$$h = \sin 67° (489 mi) = \underline{\underline{450 mi}}$$

15. Solve the equation shown for the variable Cy

2 kip x (6 ft) + 12 kip x (5 ft) – Cy x (12 ft) = 0

$12 \text{ kip} \cdot ft + 60 \text{ kip} \cdot ft = Cy \times 12 ft$

$$Cy = \frac{72 \text{ kip} \cdot ft}{12 ft} = \underline{\underline{6 \text{ kip}}}$$