Mathematical concepts like **Pythagoras' Theorem**, **sine**, **cosine**, and **tangent** (trigonometry) play a **critical role** in **disaster management**, especially in **mapping, rescue operations, measuring distances and heights**, and **planning evacuation routes**.

Here's how each concept is used, with **clear, real-life examples**:

🔷 1. Pythagoras' Theorem

🔷 Formula:

$$a^2 + b^2 = c^2$$

(where **c** is the hypotenuse)

✅ Example:

A rescue team needs to reach a victim who is **80 meters east** and **60 meters north** from their current location. They want to take the **shortest path** (diagonally).

$$c^2 = 80^2 + 60^2 = 6400 + 3600 = 10,000 \Rightarrow c = \sqrt{10,000} = 100 \text{ meters}$$

➡️ The **shortest path** is **100 meters**.

🔷 2. **Sine (sin)**

🔷 Formula:

$$\sin(\theta) = \frac{\text{opposite}}{\text{hypotenuse}}$$

✅ Example:

A drone takes off and flies at an angle of **30°** to the ground. After flying **100 meters**, how high is it above the ground?

$$\sin(30^\circ) = \frac{h}{100} \Rightarrow \frac{1}{2} = \frac{h}{100} \Rightarrow h = 50 \text{ meters}$$

➡️ The drone is **50 meters high** — useful for aerial observation in floods or earthquakes.

🔷 3. **Cosine (cos)**

🔷 **Formula:**

$$\cos(\theta) = \frac{\text{adjacent}}{\text{hypotenuse}}$$

✅ **Example:**

A rescue rope is attached from the top of a **50-meter cliff** to the ground. The rope makes a **60° angle** with the ground. How far is the rope's anchor point from the base of the cliff?

$$\cos(60^\circ) = \frac{d}{50} \Rightarrow \frac{1}{2} = \frac{d}{50} \Rightarrow d = 25 \text{ meters}$$

➡️ The anchor point is **25 meters away** from the base.

🔷 4. Tangent (tan)

🔷 Formula:

$$\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}}$$

✅ Example:

A surveillance camera is placed **40 meters** away from a wall and is aimed **30 meters high** up the wall.

$$\tan(\theta) = \frac{30}{40} = 0.75 \Rightarrow \theta = \tan^{-1}(0.75) \approx 36.87^\circ$$

➡️ The camera needs to be angled at approximately **37°** to monitor the area.

✅ Summary Table:

Concept	Formula	Use in Disaster Management	Example Result
Pythagoras	$a^2 + b^2 = c^2$	Shortest path to victim	100 m
Sine	$\sin(\theta) = \frac{\text{opp}}{\text{hyp}}$	Drone height calculation	50 m
Cosine	$\cos(\theta) = \frac{\text{adj}}{\text{hyp}}$	Rope anchor from base	25 m
Tangent	$\tan(\theta) = \frac{\text{opp}}{\text{adj}}$	Camera angle setup	37°

🧠 Real-World Applications in Disaster Management:

- **Landslide mapping**: Use trigonometry to estimate slope angles.
- **Search & rescue**: Use Pythagoras to find shortest path or elevation.
- **Evacuation drone pathing**: Use sine and cosine to measure flight angles and distances.
- **Bridge or rope rescue**: Use trig to find rope lengths and anchor positions.