

Exercise: Moment

Moment Formula

- **Moment (M) = Force (F) x Distance (d)**

where:

- **Moment is measured in Newton-meters (Nm),**
- **Force is measured in Newtons (N),**
- **Distance is the perpendicular distance from the pivot to the line of action of the force (measured in meters).**

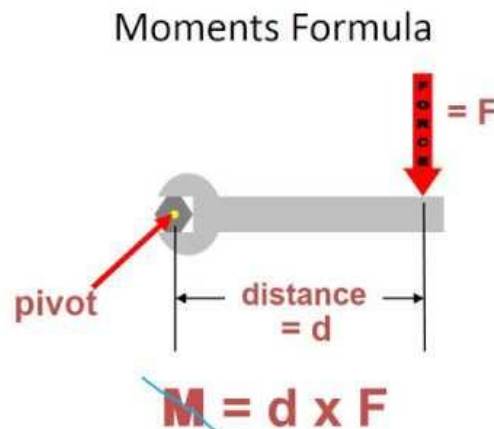
Questions

Part 1: Basic Questions (Simple Calculations)

1. **Calculate the moment:**
 - **A 10 N force is applied at a perpendicular distance of 2 m from a pivot.**

What is the moment?

- **Solution: Moment = 10 N * 2 m = 20 Nm.**



(from Mr. T Stem youtube channel)

2. **Calculate the moment:**
 - **A 15 N force is applied 0.5 m from the pivot. What is the moment?**

3. Calculate the force:
- The moment is 25 Nm, and the distance from the pivot is 5 m. What is the force applied?

3a. Calculate the force:

- A moment of 40 Nm is created when a force is applied 4 m from the pivot. What is the force?

3b. Calculate the force:

- If a 9 Nm moment is created 0.3 m from a pivot, what is the force?

3c. Calculate the distance:

- A 5 N force generates a 15 Nm moment. How far is the force from the pivot?

Part 2: Intermediate Questions (Involving Distance, Displacement, and Unit Conversions)

4. Distance and Unit Conversion:

- **A 20 N force is applied 150 cm from a pivot. Calculate the moment in Nm.**
- **Solution: Convert 150 cm to meters (150 cm = 1.5 m), Moment = 20 N * 1.5 m = 30 Nm.**

4a. Distance Conversion:

- A 12 N force is applied at 120 cm from the pivot. Calculate the moment in Nm.

4b. Moment in Different Units:

- A 25 N force is applied 250 cm from a pivot. Calculate the moment in Nm.

4c. Force Calculation with Unit Conversion:

- A 60 Nm moment is created at 150 cm from a pivot. What is the force in Newtons?

5. Calculating Force with Displacement:

- **A force creates a moment of 45 Nm when applied at a distance of 3 m from the pivot. If the force was applied at a 90-degree angle, what is the magnitude of the force?**

- **Solution: Force = Moment / Distance = 45 Nm / 3 m = 15 N.**

5a. Displacement Calculation:

- A moment of 36 Nm is produced by a 9 N force. What is the perpendicular distance from the pivot?

5b. Moment with Non-Perpendicular Force:

- A 20 N force is applied at a 30-degree angle to a 1.5 m lever arm. Calculate the moment.

5c. Calculating Moment:

- A 40 N force is applied 2 m from a pivot, but only 1.5 m is perpendicular. Calculate the moment.

6. Distance to Achieve a Specific Moment:

- **To create a moment of 100 Nm with a force of 25 N, what should the distance from the pivot be?**

- **Solution: Distance = Moment / Force = 100 Nm / 25 N = 4 m.**

6a. Distance Calculation:

- A 100 Nm moment is desired with a 20 N force. How far should the force be applied?

6b. Finding Distance for Specific Moment:

- What distance is needed to create a 75 Nm moment with a 15 N force?

6c. Moment Requirement with Distance:

- To produce a 50 Nm moment with a 10 N force, how far should the force be from the pivot?

7. Moment Calculation with Change in Distance:

• **A 12 N force is applied 0.4 m from a pivot. If the distance is doubled, what is the new moment?**

• **Solution: Initial Moment = $12\text{ N} \times 0.4\text{ m} = 4.8\text{ Nm}$. Doubling the distance, New Moment = $12\text{ N} \times 0.8\text{ m} = 9.6\text{ Nm}$.**

7a. Doubling Distance Calculation:

- A 6 N force is applied at 0.25 m from a pivot. If the distance is tripled, what is the new moment?

7b. Moment with Half Distance:

- A 50 N force creates a moment at 2 m from a pivot. What is the moment if the distance is halved?

7c. Changing Distance by Factor:

- A 25 N force acts 1 m from the pivot. If the distance is increased by a factor of 4, what is the new moment?

8. Time-Based Problem:

- **A 30 N force is applied 2 m from a pivot, creating a moment of 60 Nm. If the force is applied for 5 seconds, what is the work done in maintaining this force at that distance?**

- **Solution: Work = 30 N * 2 m * 5 s = 300 J.**

8a. Calculating Work Over Time:

- A 10 N force acts 1.5 m from a pivot for 8 seconds. What is the total work done?

8b. Force Duration for Work Calculation:

- A 12 N force acts at 2 m from a pivot for 10 seconds. Calculate the work done.

8c. Work Done in Applying Force:

- A 15 N force acts 3 m from a pivot for 6 seconds. What is the work done?

9. Comparing Moments with Different Units:

- **A force of 50 N is applied 0.3 m from a pivot, creating a moment of 15 Nm.**

What would the moment be if the distance was measured in centimeters?

- **Solution: Moment = 50 N * 30 cm = 1500 Ncm.**

9a. Moment in Centimeters:

- A 20 N force is applied 2 m from a pivot. Calculate the moment in Ncm.

9b. Moment with Distance in Millimeters:

- A 10 N force acts 1.5 m from a pivot. What is the moment in Nmm?

9c. Unit Conversion Practice:

- A 30 N force applied 1 m from the pivot creates a moment of 30 Nm. What is the equivalent moment in Ncm?

Q10: Displacement with Negative Moment

10. Displacement with Negative Moment:

- A 40 N force acts 1 m from a pivot in the opposite direction of the positive direction. Calculate the moment and specify if it's positive or negative.
- **Solution: Moment = Force * Distance = 40 N * 1 m = 40 Nm (negative due to opposite direction).**

10a. Calculating Negative Moment:

- A 25 N force acts 2 m from a pivot in the opposite direction. Calculate the moment and its direction.

10b. Moment with Reversed Force:

- A 30 N force applied 1.5 m from the pivot in the opposite direction of positive creates what moment?

10c. Negative Moment Calculation:

- A 10 N force acts at 3 m from the pivot in the opposite direction. What is the moment?

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Part 1: Basic Questions (Simple Calculations)

1. Calculate the moment:
 - A 10 N force is applied at a perpendicular distance of 2 m from a pivot. What is the moment?
 - Solution: Moment = $10 \text{ N} \times 2 \text{ m} = 20 \text{ Nm}$.
2. Calculate the moment:
 - A 15 N force is applied 0.5 m from the pivot. What is the moment?
3. Calculate the force:
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- Solution: $\text{Distance} = \text{Moment} / \text{Force} = 100 \text{ Nm} / 25 \text{ N} = 4 \text{ m}$.

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