Lesson 2b - Moments and Balance

Physics - KS3

Forces in Action

Mrs Wolstenholme

Reminder:
Two options to make a moment bigger

Make my force large

Make the perpendicular distance from my force to the pivot bigger

Credit: no attribution required

What can I do to increase the moment?

Option 1

Move the force closer to the pivot

Option 2

Move the force up

Option 3

Move the force further away from the pivot

Option 4

Move the force down

What can I do to decrease the moment?

Option 1

Move the force closer to the pivot

Option 2

Move the force up

Option 3

Move the force further away from the pivot

Option 4

Move the force down

If I push further away from the pivot the moment is ……..

Option 1

smaller

Option 2

the same

Option 3

larger

Option 4

zero

If I push closer to the pivot the moment is

.....

Option 1	Option 2
smaller	the same
Option 3	**Option 4**
larger	zero

See diagram on lesson video

Q1. The diagram shows a crane lifting a load. The counterweight and the load are balanced.

(a) The load is moved away from the pivot, to the right.

(i) What happens to the turning moment produced by the load?

.....

1 mark

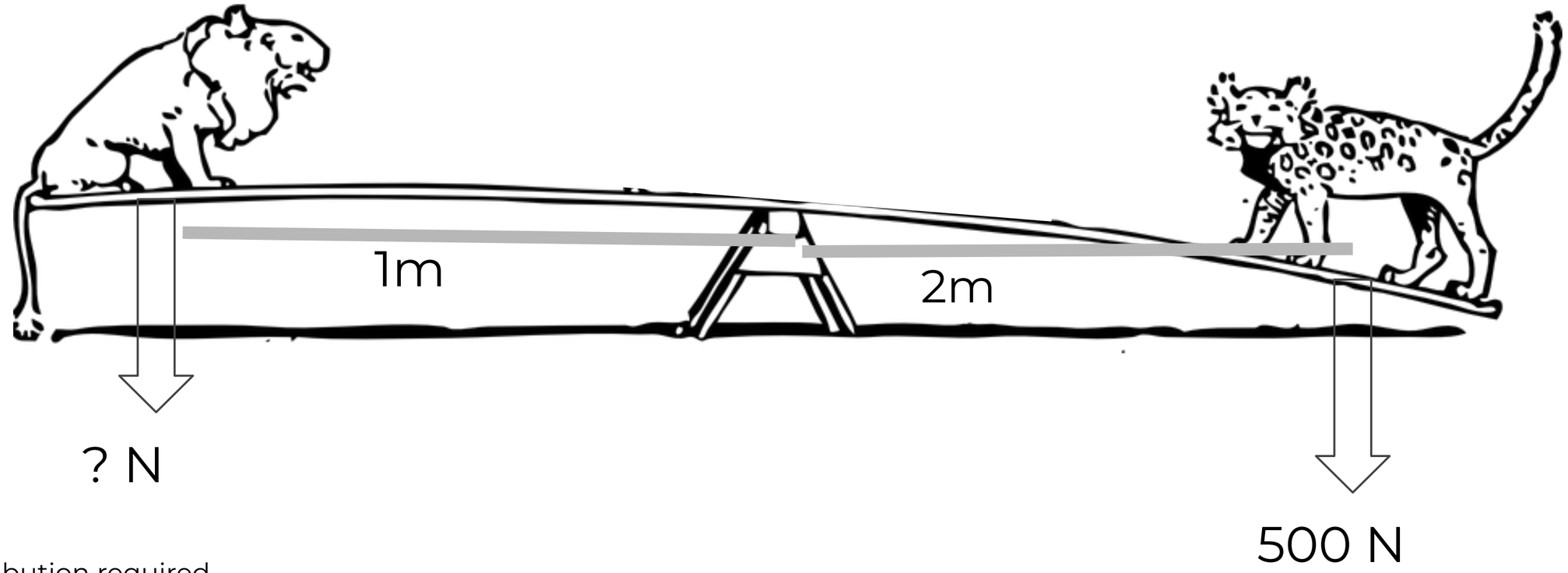
(ii) What should happen to the counterweight to keep the arm balanced?

.....

.....

1 mark

The seesaw is balanced. What is the weight of the animal on the left?



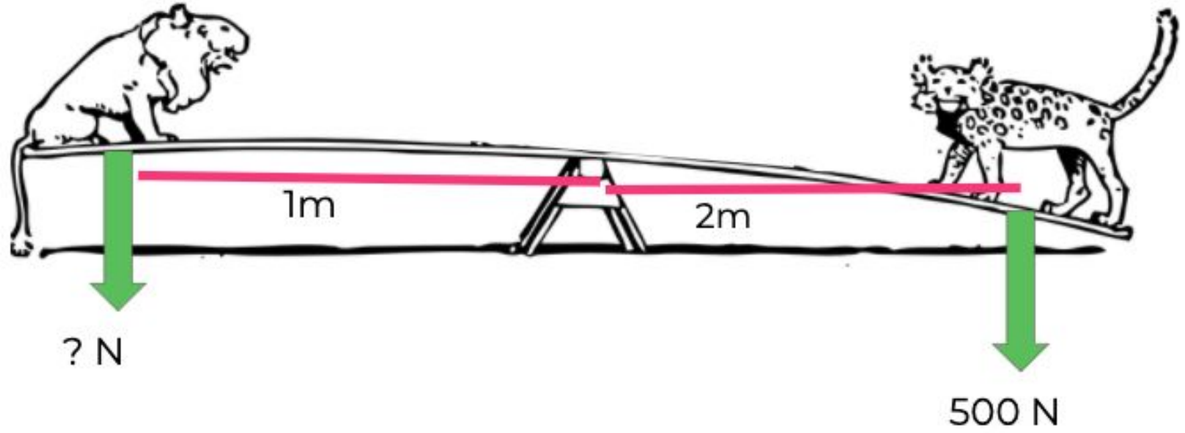
Credit: no attribution required

Reminder

Moment = Force x Perpendicular Distance

Balanced : Clockwise Moment = Anticlockwise Moment

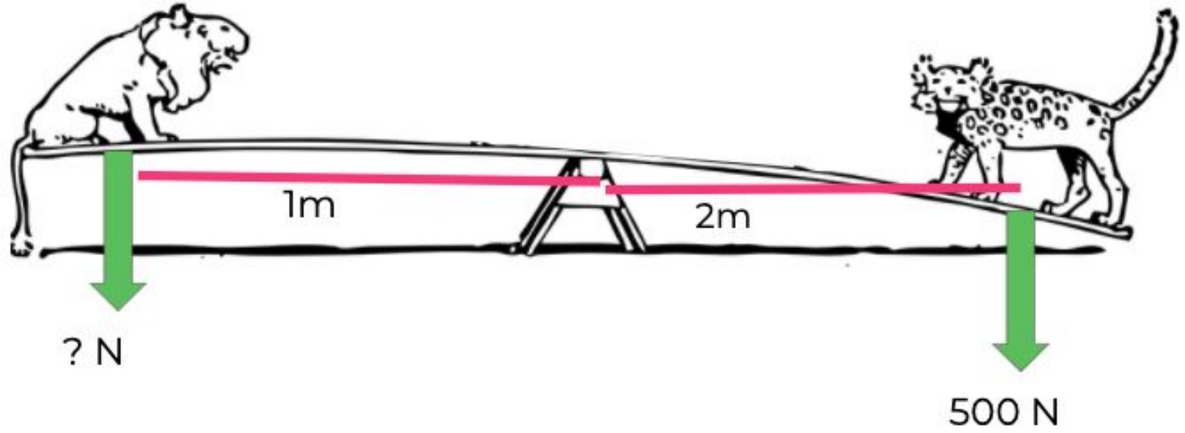
The seesaw is balanced. What is the weight of the animal on the left?



Clockwise moment = Anticlockwise moment

Credit: no attribution required

The seesaw is balanced. What is the weight of the animal on the left?

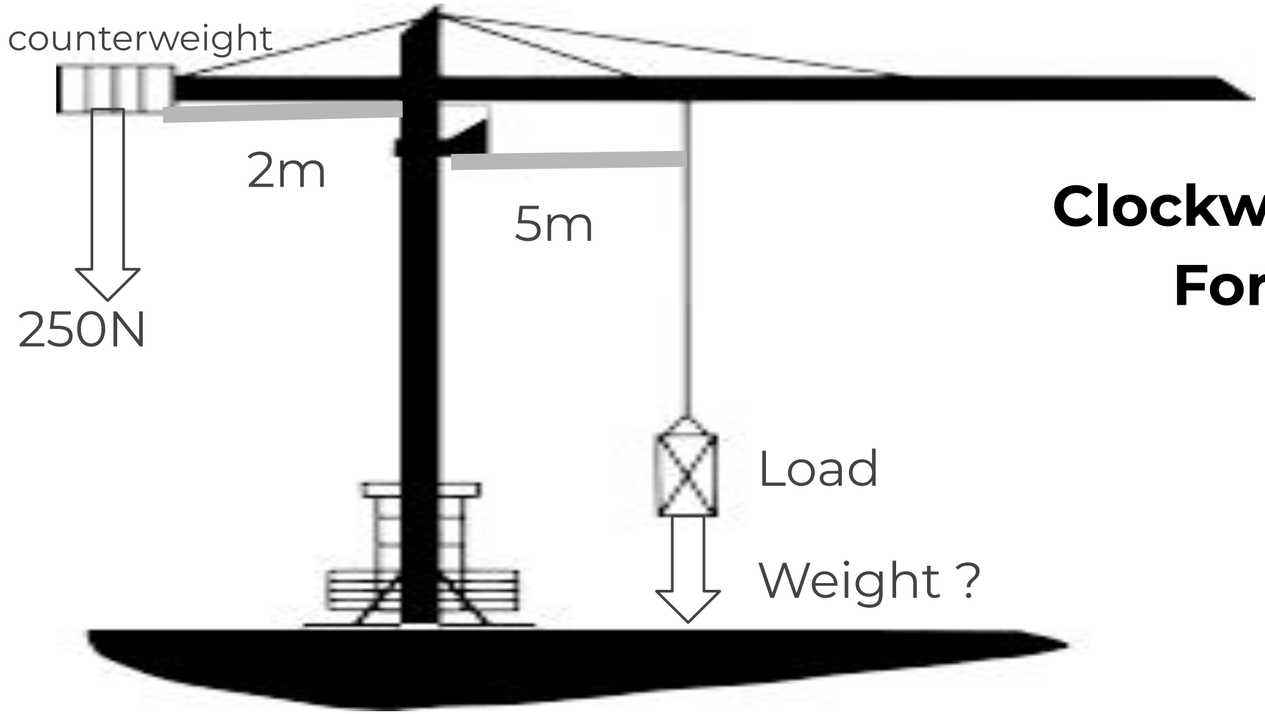


Clockwise moment = Anticlockwise moment

Force x distance = Force x distance

Credit: no attribution required

The crane is balanced. The weight of the counterweight is 250 N. What is the weight of the load?



Credit: no attribution required

Clockwise moment = Anticlockwise moment

Force x distance = Force x distance

What is the next step?

Weight x 4 = 400

Option 1

Weight x 4 x 4 = 400 x4

Option 2

Weight x 4 ÷ 4 = 400 ÷ 4

Option 3

Weight x 4 ÷ 4 = 400 x4

Option 4

PANIC!!

What is the next step?

Force x 2 = 600

Option 1

Force x 2 ÷ 2 = 600 ÷ 2

Option 2

Force x 2 x 2 = 600 x 2

Option 3

Force x 2 ÷ 3 = 600 ÷ 3

Option 4

PANIC!!

What is the next step?

450 = Push x 10

Option 1

450 x 10 = Push x 10 x 10

Option 2

450 ÷ 10 = Push x 10 ÷ 10

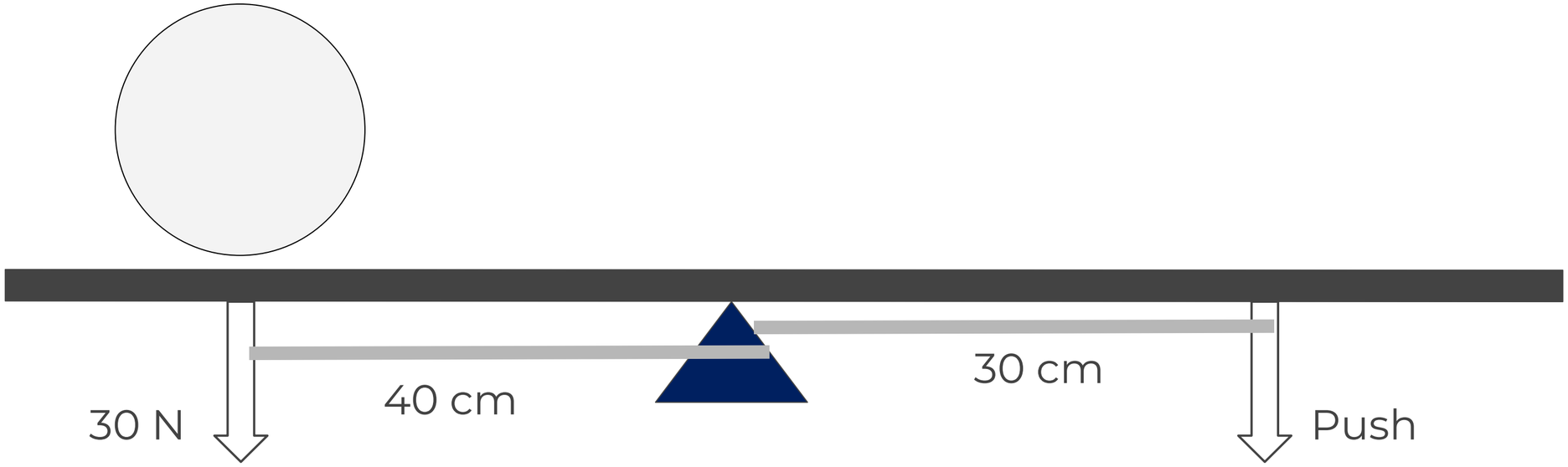
Option 3

450 ÷ 450 = Push x 10 ÷ 450

Option 4

PANIC!!

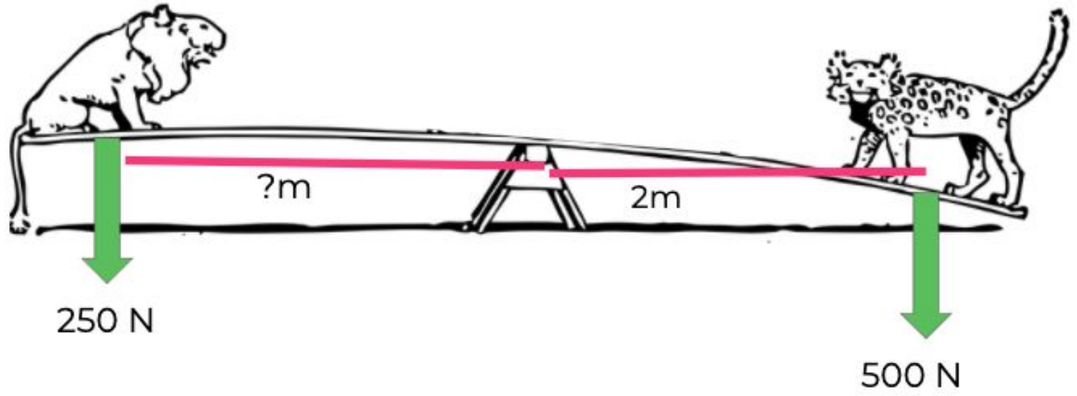
The apple has a weight of 30 N and is 40 cm away from the pivot? What force would I have to push the bar with 30 cm from the pivot to balance the bar?



Clockwise moment = Anticlockwise moment

Force x distance = Force x distance

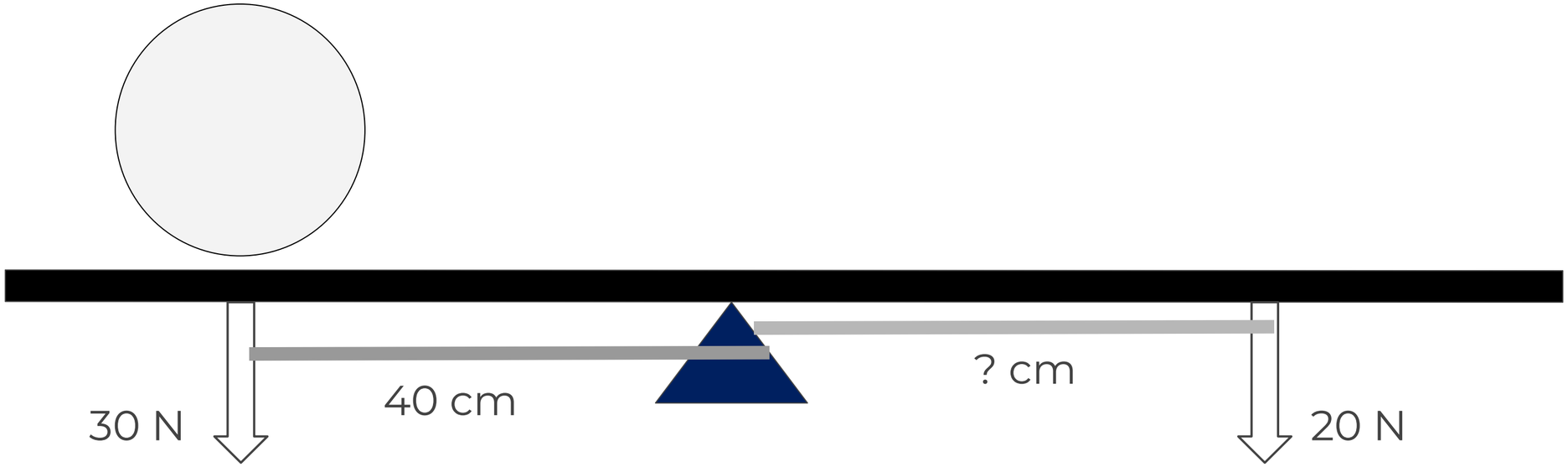
The seesaw is balanced. How far away from the pivot is the animal on the left?



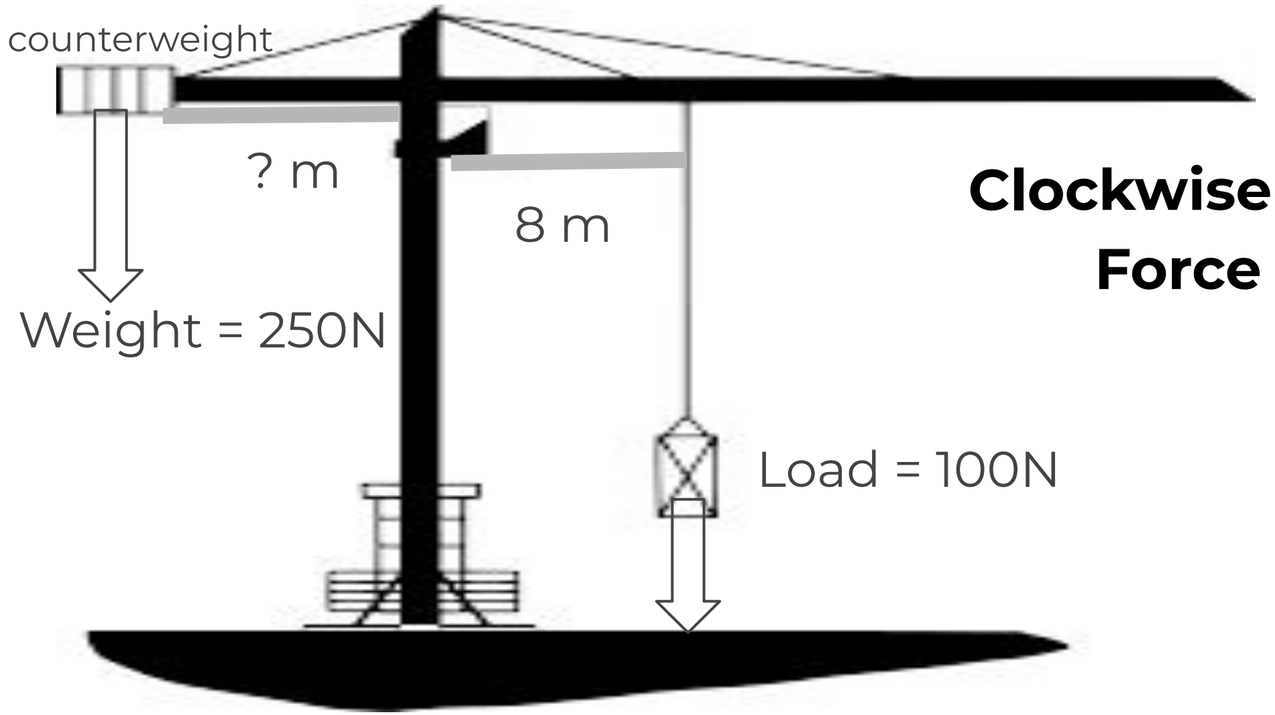
Clockwise moment = Anticlockwise moment

Credit: no attribution required

The apple has a weight of 30 N and is 40 cm away from the pivot? How far from the pivot should I push with a force of 20N to balance the bar?



How far away from the pivot does the counterweight need to be for the crane to be balanced?



Clockwise moment = Anticlockwise moment

Force x distance = Force x distance

Credit: no attribution required

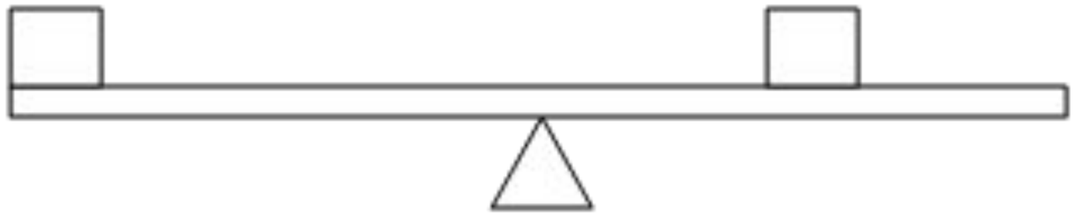
1) The weight of child A is 100 N. How far away from the pivot is child A sitting if the seesaw is balanced?

2) A balanced crane uses a 1500 N counterweight which is 1 m from the pivot. What is the weight of the load lifted 3m from the pivot?

See video for diagrams

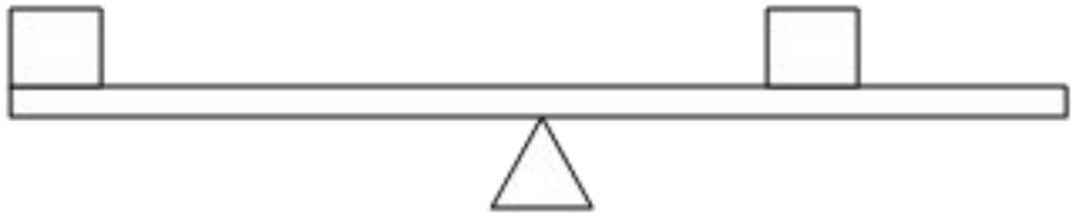
More Practice

Question 1: A load of 100N is positioned 2 metres to the left-hand side of a pivot. How far away would you have to place a 200N load on the right-hand side of the pivot?



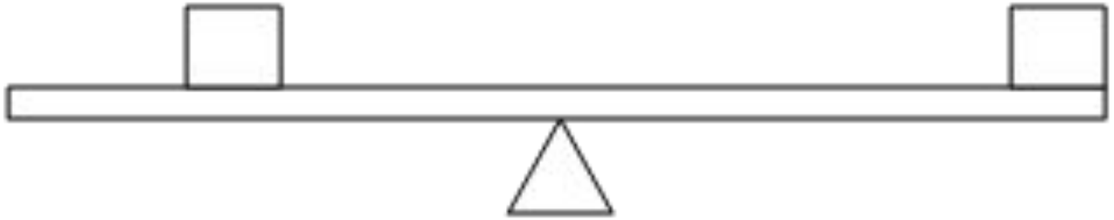
Credit: Priti Solanki

Question 2: A 150N load is held 3 metres from a pivot. If the load is balanced by another load which is 1.5 metres away from the pivot, what force is needed to do this?



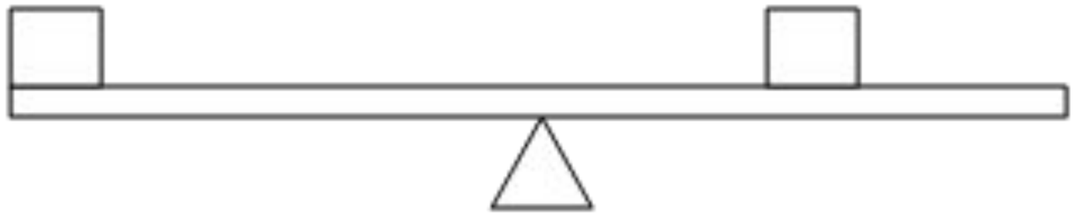
Credit: Priti Solanki

Question 3: Two pupils are sat on a seesaw. If the pupil on the left has a load of 45N and is sat 2 metres away from the pivot, how far away must the other pupil sit if they have a load of 30N?



Credit: Priti Solanki

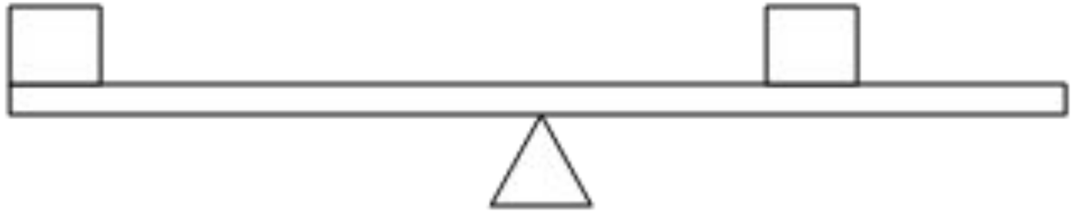
Question 4: A crane lifts a 4000N block using an arm which is 20 metres in length. If the counterweight is 2 metres from the pivot, what force must the counterweight produce?



Credit: Priti Solanki

Answers

Question 1: A load of 100N is positioned 2 metres to the left-hand side of a pivot. How far away would you have to place a 200N load on the right-hand side of the pivot?



Credit: Priti Solanki

Anticlockwise moment = clockwise moment

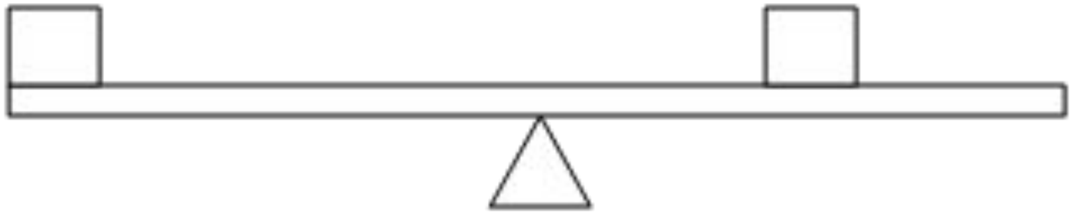
100 x 2 = 200 x distance

200 = 200 x distance

Distance = 1m

Question 2: A 150N load is held 3 metres from a pivot. If the load is balanced by another load which is 1.5 metres away from the pivot, what force is needed to do this?

Credit: Priti Solanki



Anticlockwise moment = clockwise moment

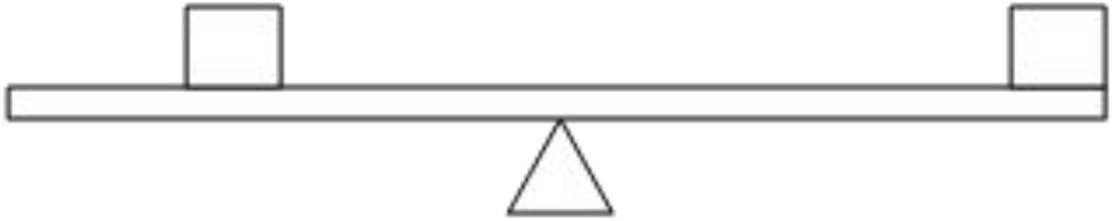
150 x 3 = Force x 1.5

450 = Force x 1.5

Force = 300 N

Question 3: Two pupils are sat on a seesaw. If the pupil on the left has a load of 45N and is sat 2 metres away from the pivot, how far away must the other pupil sit if they have a load of 30N?

Credit: Priti Solanki



Anticlockwise moment = clockwise moment

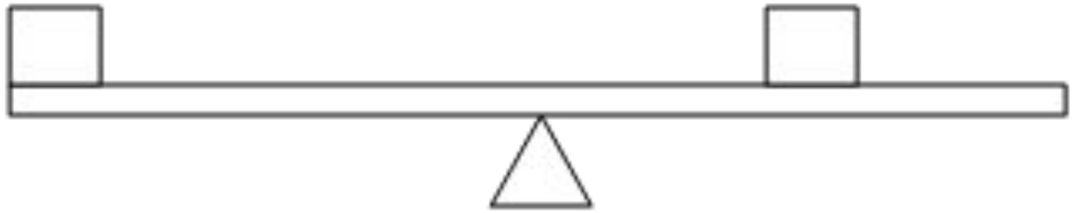
45 x 2 = 30 x distance

90 = 30 x distance

Distance = 3 m

Question 4: A crane lifts a 4000N block using an arm which is 20 metres in length. If the counterweight is 2 metres from the pivot, what force must the counterweight produce?

Credit: Priti Solanki



Anticlockwise moment = clockwise moment

4000 x 10 = Force x 2

40000 = Force x 2

Force = 20000