WORLD ASSOCIATION OF TECHNOLOGY TEACHERS

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DESIGN AND TECHNOLOGY

MATHS TIME LINE

KS 3 and 4

FIRST DRAFT

DESIGN AND TECHNOLOGY – MATHS TIME LINE

Year 7.

Understand and be able to convert cms to mms.	
To be able to measure accurately, in both cms and mms.	
To draw angles accurately and to recognise 30/45/60/90/180 and 360 degrees.	
To be able to identify geometrical shapes such as squares, rectangle, pentagon, hexagon, circles and ellipses.	
Be able to draw accurately, following dimensions / measurements and have a limited understanding of scale.	
To understand and apply radius and diameter. Understand the term circumference.	
To be able calculate totals and to work out the 'mean' average.	
Have a basic working understanding of weights and measures (E.G. in Food Technology).	
Have a basic understanding of computer control (input, process and output) through the use of microprocessor control (using purchased programmable robotic devises).	

FIRST DRAFT

DESIGN AND TECHNOLOGY – MATHS TIME LINE

Year 8. In addition to Year 7

Be able to calculate areas.	
To total ‘tally’ charts, as used in questionnaires and when collecting statistics.	
Be able to produce simple graphs from data collected during lessons	
Be able to draw common geometrical shapes accurately.	
Build on knowledge of weights and measures (E.G. Food Technology)	
Use templates / patterns to accurately mark out and manufacture.	
Use a combination of measuring and marking out skills.	
Be able to control simple 'robotic' devices / components (motors, sensors, switches) through basic programming or the use of control software.	

DESIGN AND TECHNOLOGY – MATHS TIME LINE

Year 9. In addition to Years 7 and 8

Be able to calculate volumes	
Be able to calculate percentages	
To apply scale to drawings	
Use ratios and percentages.	
Understand tessellations and how efficient designs can be based on them.	
Determine angular measures in degrees (E.G. using a protractor accurately).	
Be able to draw and make templates / patterns to aid batch manufacture.	
To be able to control microprocessor circuits (manufactured in class E.G. Genie programmable circuits), using code and / or control software.	
To have an understanding of basic formulas, as used in electronics (E.G. Ohms Law)	
To be able to calculate simple moments of force and equilibrium.	
To be able to 'geometrically' identify the centre of gravity of a 2D shape.	
Be able to work out simple gear ratios for spur gears.	

DESIGN AND TECHNOLOGY – MATHS TIME LINE

KS 4. In addition to Years 7, 8 and 9

Arithmetic and Numerical Problem Solving Be able to calculate quantities of materials, costs and sizes. Be able to calculate ratios and percentages. Understand and apply knowledge of fractions. Be able to scale drawings including working drawings. Analyse the results of questionnaires. Calculate areas and volumes.	
Data Handling and Practical Application Be able to presentation data in the form of diagrams, pictograms, bar charts, pie charts, line graphs etc.... Be able to produce frequency tables and use information gathered to help determine solutions to design problems.	
Graphical Presentation Be able to draw a range of graphs from data / statistics. Present data in the form of graphs (See above). Be able to convert information and data from statistical form to graph form and vise versa . To be able to use technical specifications, as supplied by manufacturers, when analising products, making choices and determining a design.	
Geometry and Trigonometry To determine angular measures, in degrees. To be able to measure and mark out accurately. To be able to use tessellated patterns (E.G. using a template or a pattern in Batch Production). Be able to draw in 2D and 3D, both by hand and using CAD. To be able to present designs in an understandable, standardised form (E.G. scaled working drawings) To be able to calculate the areas and volumes and consequently, the quantity of material required, for the manufacture of a product.	

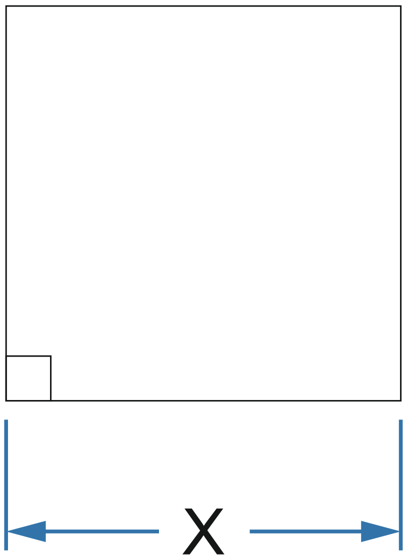
MATHEMATICAL SKILLS

AREA OF A SQUARE
AND
ASSOCIATED EXAMINATION QUESTIONS

DESIGN AND TECHNOLOGY

CALCULATING THE AREA OF A SQUARE

Definition: A square has four sides, with each being equal in length. Each of the four internal angles are right angles, 90 degrees.



FORMULA

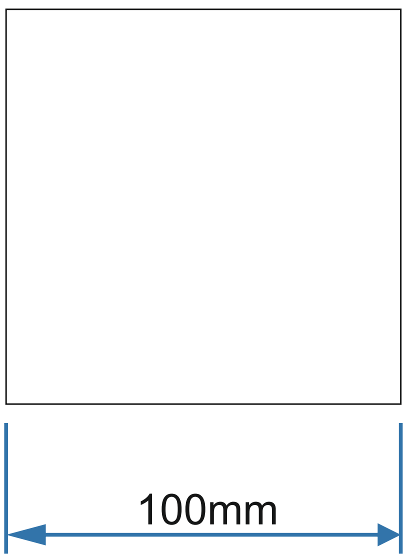
AREA = X^2

OR X = X multiplied by X

X IS THE LENGTH OF ONE SIDE

REMEMBER, WITH A SQUARE,
EACH SIDE IS THE SAME LENGTH

SAMPLE QUESTIONS

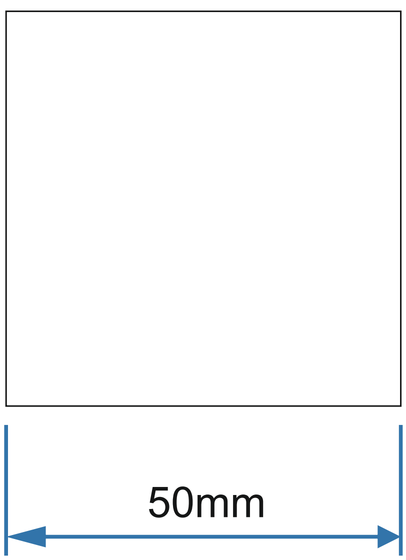


Calculate the area of the square shown opposite.
The length of one side is 100mm

AREA = X^2

AREA = 100mm x 100mm

AREA = 10000mm^2



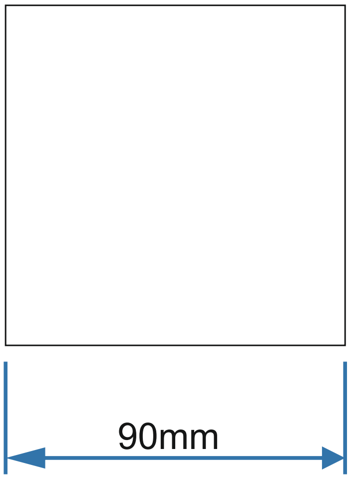
Calculate the area of the square shown opposite.
The length of one side is 50mm

AREA = X^2

AREA = 50mm x 50mm

AREA = 2500mm^2

SAMPLE QUESTIONS

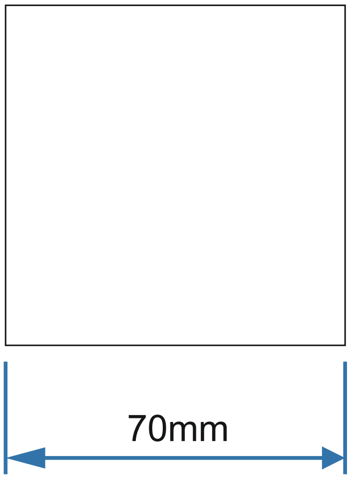


Calculate the area of the square shown opposite.
The length of one side is 90mm

AREA = X^2

AREA = 90mm x 90mm

AREA = 8100mm^2

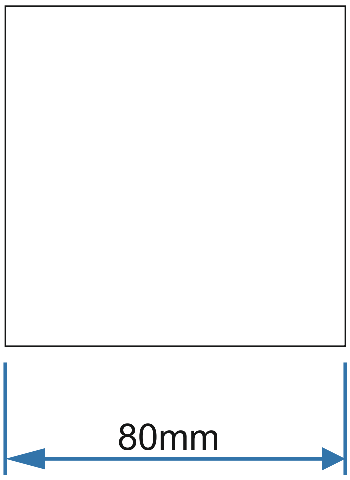


Calculate the area of the square shown opposite.
The length of one side is 70mm

AREA = X^2

AREA = 70mm x 70mm

AREA = 4900mm^2

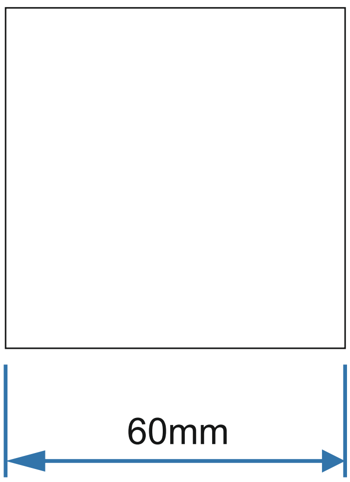


Calculate the area of the square shown opposite.
The length of one side is 80mm

AREA = X^2

AREA = 80mm x 80mm

AREA = 6400mm^2



Calculate the area of the square shown opposite.
The length of one side is 60mm

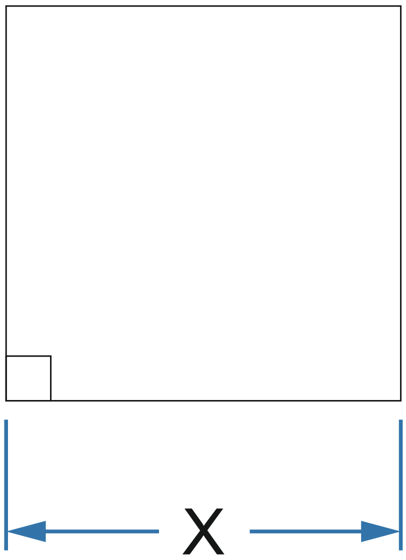
AREA = X^2

AREA = 60mm x 60mm

AREA = 3600mm^2

CALCULATING THE AREA OF A SQUARE

Definition: A square has four sides, with each being equal in length. Each of the four internal angles are right angles, 90 degrees.



FORMULA

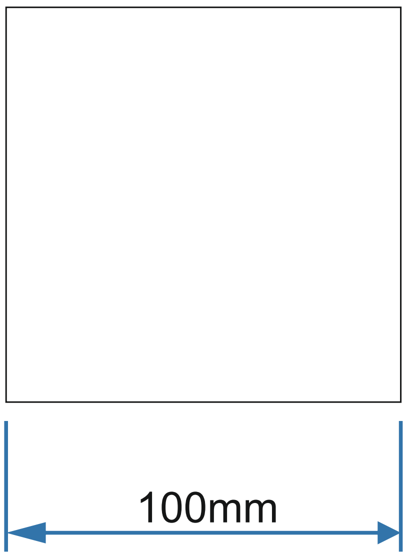
AREA = X^2

OR X = X multiplied by X

X IS THE LENGTH OF ONE SIDE

REMEMBER, WITH A SQUARE, EACH SIDE IS THE SAME LENGTH

SAMPLE QUESTIONS



Calculate the area of the square shown opposite.
The length of one side is 100mm

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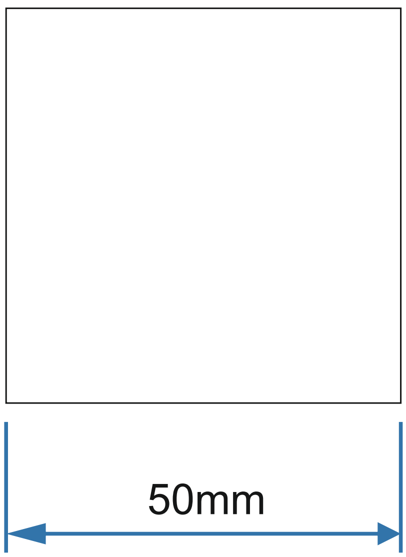

Calculate the area of the square shown opposite.
The length of one side is 50mm

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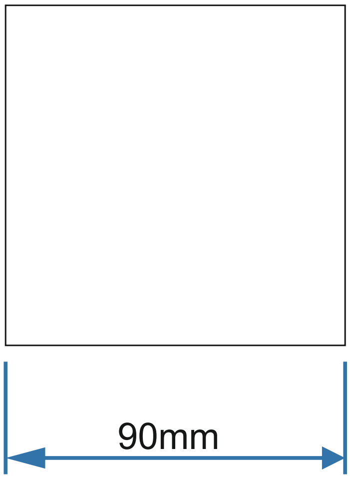
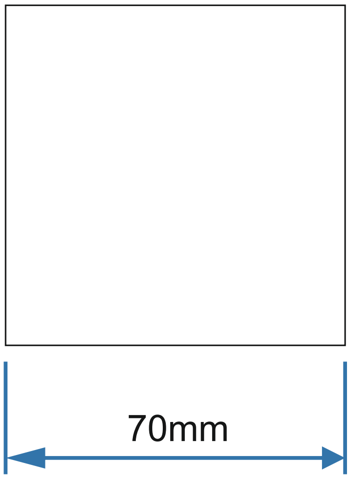
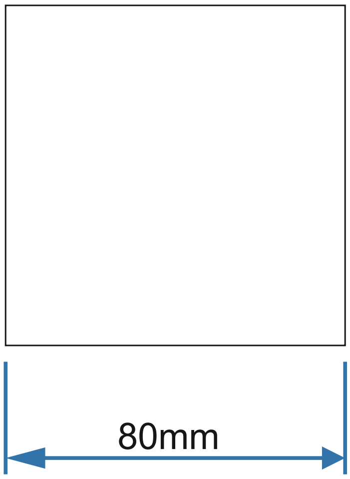
SAMPLE QUESTIONS



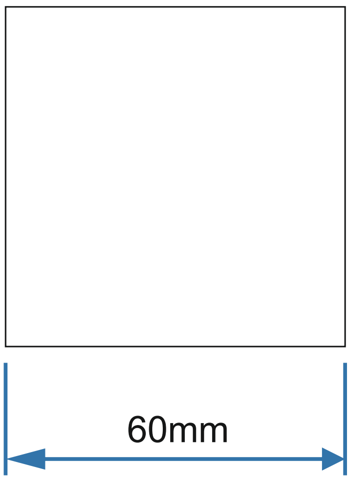
Calculate the area of the square shown opposite.
The length of one side is 90mm



Calculate the area of the square shown opposite.
The length of one side is 70mm



Calculate the area of the square shown opposite.
The length of one side is 80mm



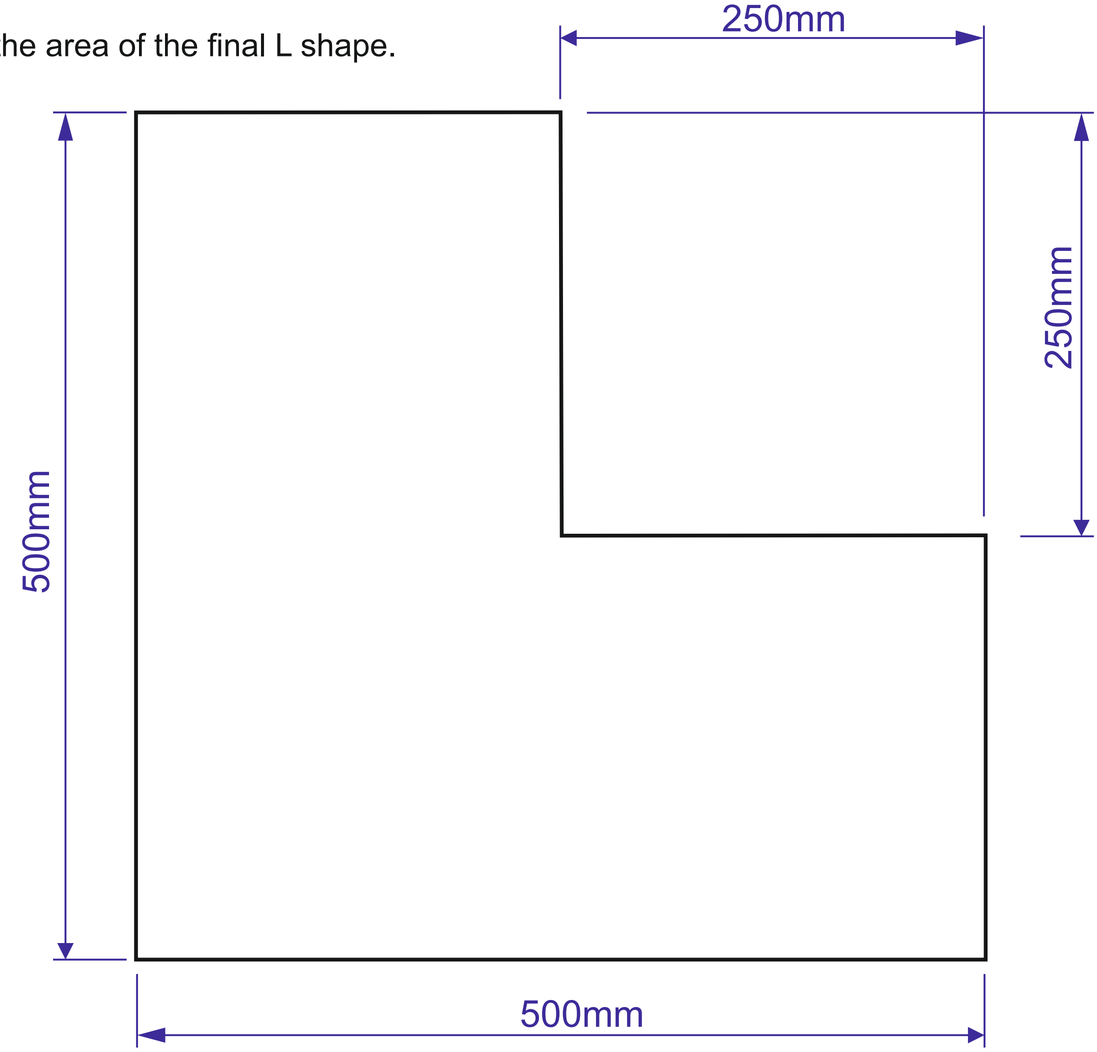
Calculate the area of the square shown opposite.
The length of one side is 60mm

AREA OF A SQUARE - EXAMINATION QUESTION

A plywood panel for a cabinet is seen below.

1. Calculate the area of the plywood required, before it is cut to shape (the overall square of plywood required, before it is cut to an L shape).

2. Calculate the area of the final L shape.



First, calculate the area of the uncut plywood, by treating it as a square 500mm x 500mm.

AREA = LENGTH OF SIDE X LENGTH OF SIDE
AREA = 500 X 500
AREA = 250000mm²

Now, calculate the area of the smaller piece to be cut away, during the shaping of the panel

AREA = LENGTH OF SIDE X LENGTH OF SIDE
AREA = 250 X 250
AREA = 62500mm²

Now subtract the smaller area from the area of the uncut plywood.

250000 - 62500 = 187500

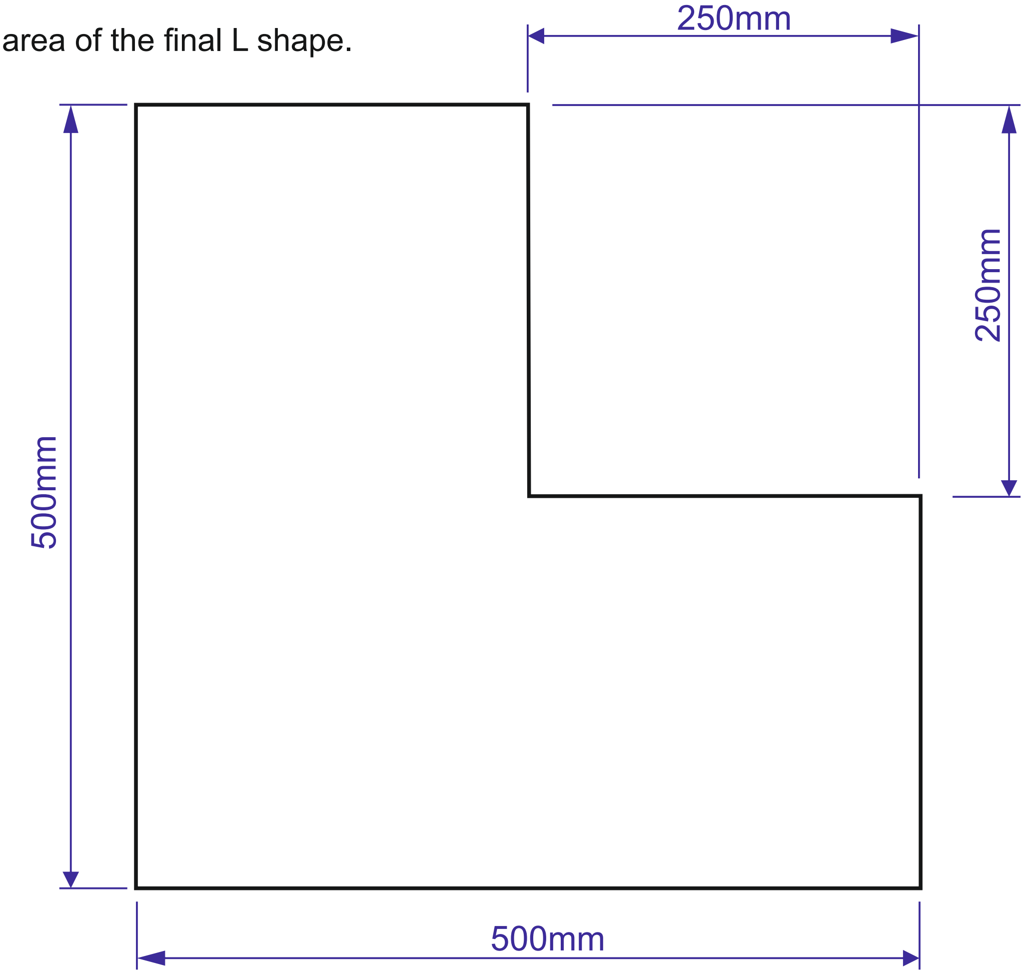
AREA OF FINAL SHAPED PIECE IS 187500mm²

AREA OF A SQUARE - EXAMINATION QUESTION

A plywood panel for a cabinet is seen below.

1. Calculate the area of the plywood required, before it is cut to shape (the overall square of plywood required, before it is cut to an L shape).

2. Calculate the area of the final L shape.

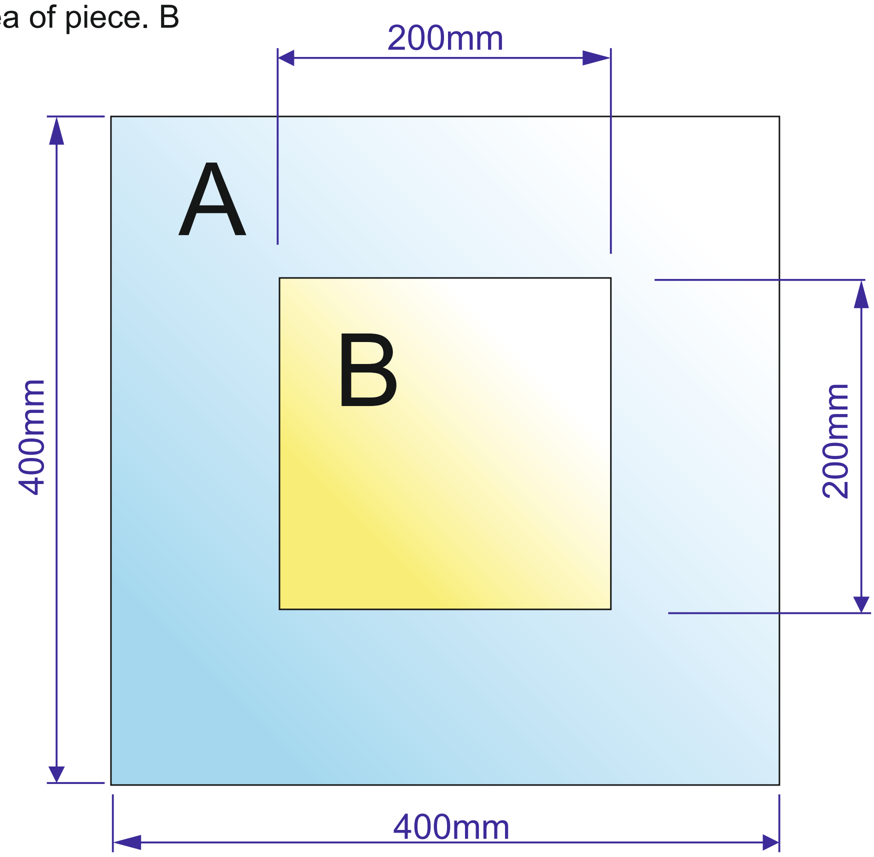


AREA OF A SQUARE - EXAMINATION QUESTION

An acrylic window for a school project seen below, is composed of two pieces, accurately cut to size on a laser cutter. They fit perfectly together.

1. Calculate the area of piece A

2. Calculate the area of piece. B



First, calculate the entire area of 'A', without the centre piece being removed, by treating it as a square 400mm x 400mm.

AREA = LENGTH OF SIDE X LENGTH OF SIDE
AREA = 400 X 400
AREA = 160000mm^2

Now, calculate the area of the smaller piece 'B', *which is also the size of the piece to be removed from 'A'.*

AREA = LENGTH OF SIDE X LENGTH OF SIDE
AREA = 200 X 200
AREA = 40000mm^2

Now subtract the smaller area 'B' from the area of 'A'. The answer will be the area of 'A' with it's central window of material removed.

160000 - 40000 = 120000mm^2

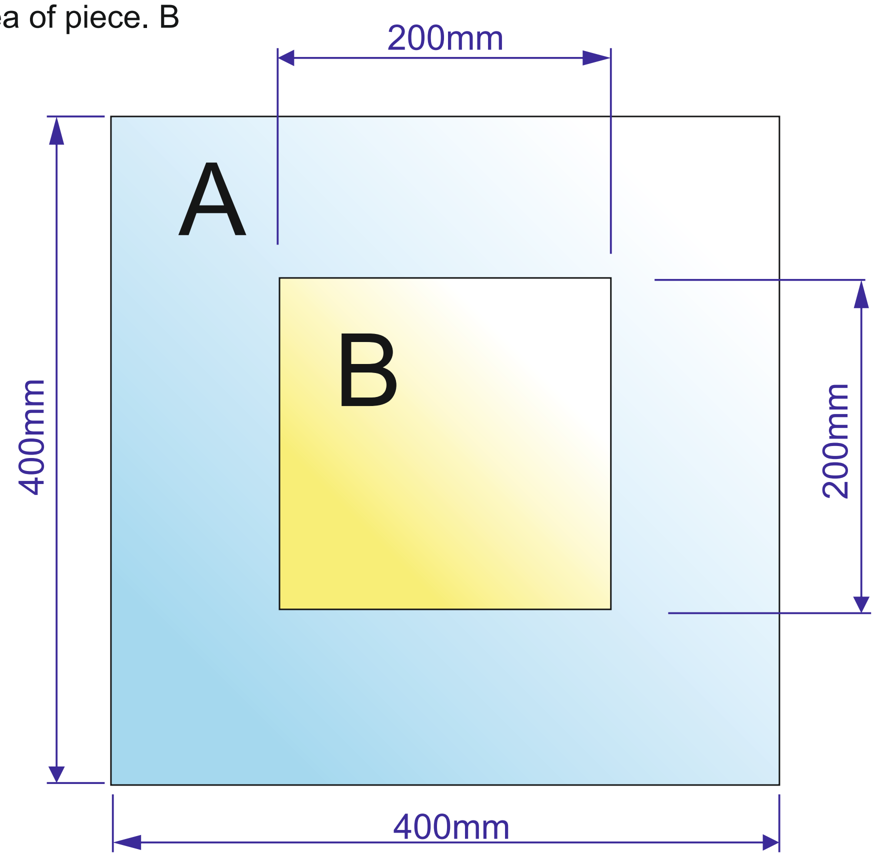
AREA OF FINAL SHAPED PIECE 'A' WITHOUT CENTRAL PIECE IS 120000mm^2
AREA OF PIECE 'B' IS 40000mm^2

AREA OF A SQUARE - EXAMINATION QUESTION

An acrylic window for a school project seen below, is composed of two pieces, accurately cut to size on a laser cutter. They fit perfectly together.

1. Calculate the area of piece A

2. Calculate the area of piece. B



MATHEMATICAL SKILLS

AREA OF A RECTANGLE
AND
ASSOCIATED EXAMINATION QUESTIONS

DESIGN AND TECHNOLOGY

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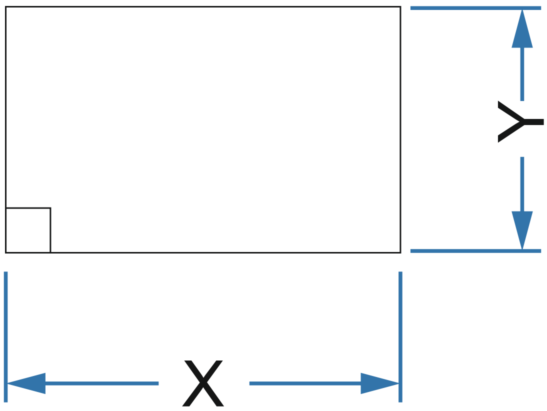
CALCULATING THE AREA OF A RECTANGLE

Definition: A rectangle has four sides, with the opposite sides being the same length and parallel. Each of the four internal angles are right angles, 90 degrees.

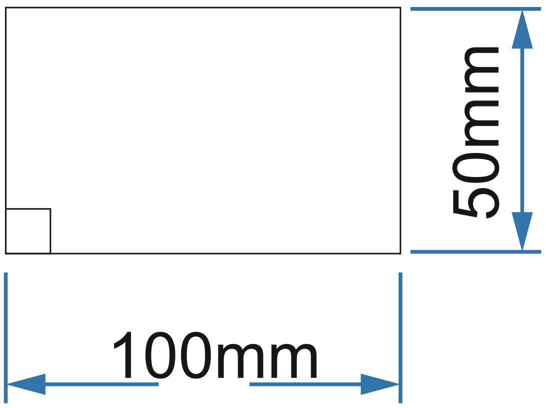


FORMULA

AREA = X multiplied by Y

AREA =LENGTH x HEIGHT

SAMPLE QUESTIONS

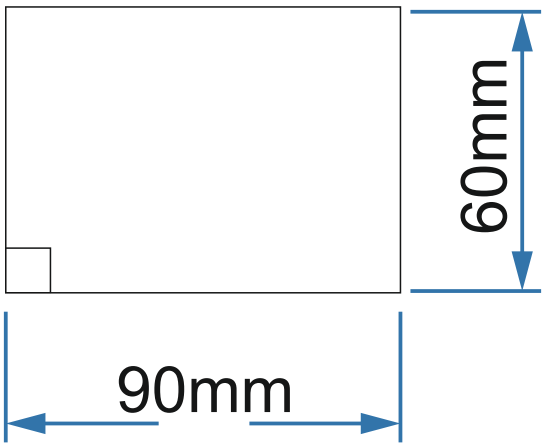


Calculate the area of the rectangle shown opposite.

AREA = X multiplied by Y

AREA = 100mm x 50mm

AREA = 5000mm^2



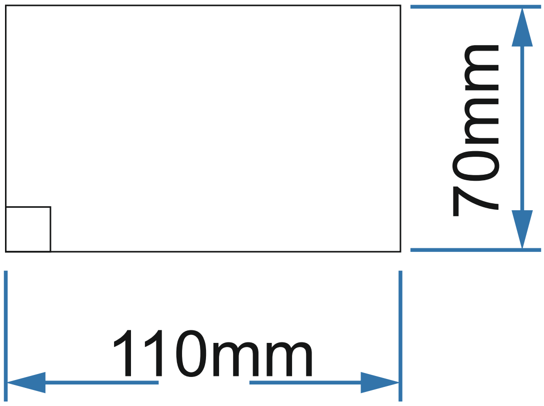
Calculate the area of the rectangle shown opposite.

AREA = X multiplied by Y

AREA = 90mm x 60mm

AREA = 5400mm^2

SAMPLE QUESTIONS

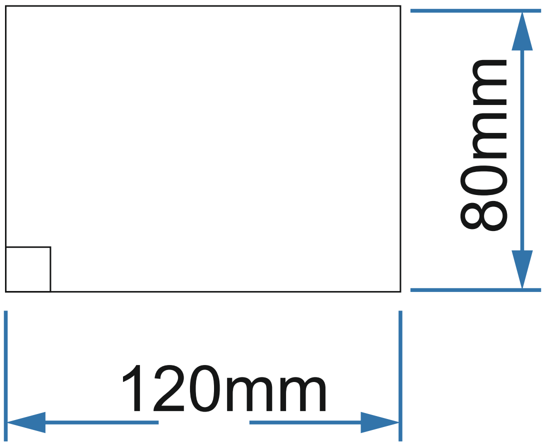


Calculate the area of the rectangle shown opposite.

AREA = X multiplied by Y

AREA = 110mm x 70mm

AREA = 7700mm²

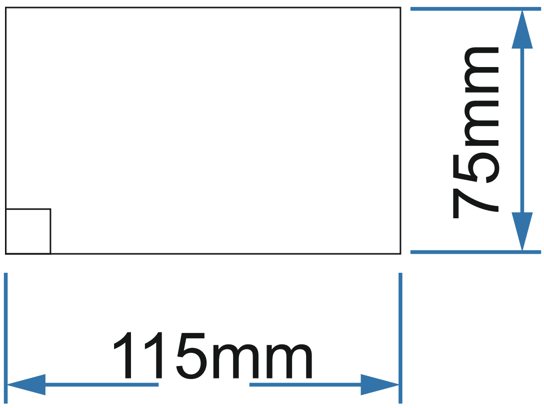


Calculate the area of the rectangle shown opposite.

AREA = X multiplied by Y

AREA = 120mm x 80mm

AREA = 9600mm²

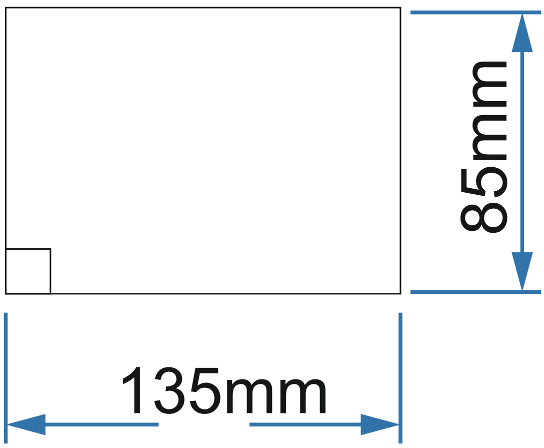


Calculate the area of the rectangle shown opposite.

AREA = X multiplied by Y

AREA = 115mm x 75mm

AREA = 8625mm²



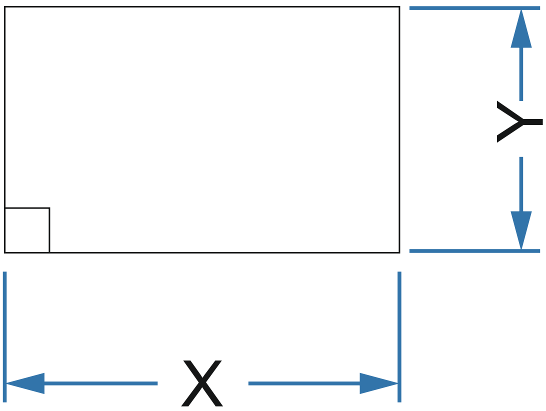
Calculate the area of the rectangle shown opposite.

AREA = X multiplied by Y

AREA = 135mm x 85mm

AREA = 11475mm²

Definition: A rectangle has four sides, with the opposite sides being the same length and parallel. Each of the four internal angles are right angles, 90 degrees.

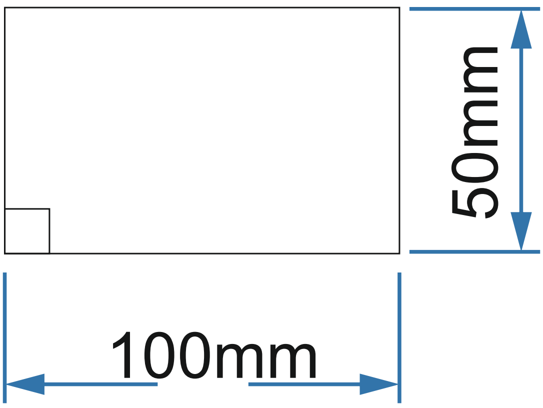


FORMULA

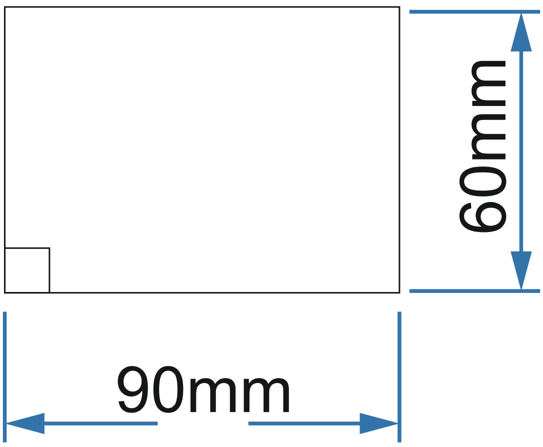
AREA = X multiplied by Y

AREA =LENGTH x HEIGHT

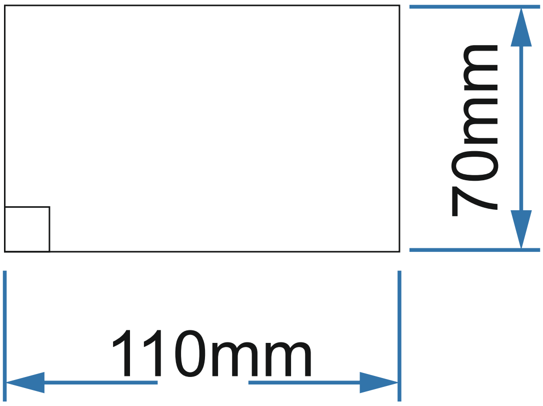
SAMPLE QUESTIONS



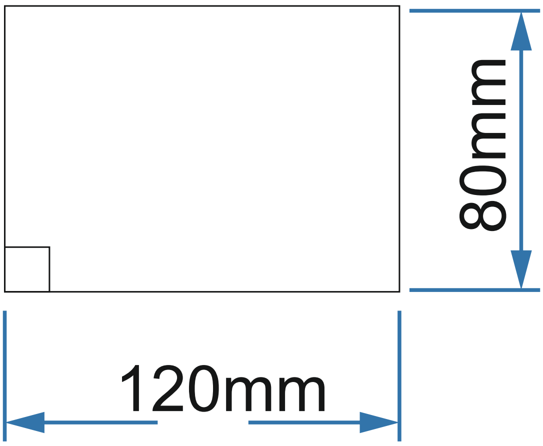
Calculate the area of the rectangle shown opposite.



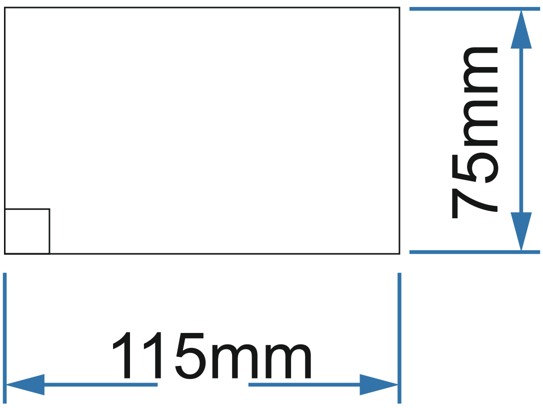
Calculate the area of the rectangle shown opposite.



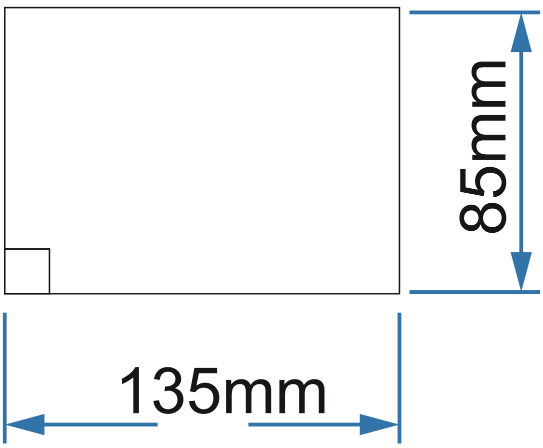
Calculate the area of the rectangle shown opposite.



Calculate the area of the rectangle shown opposite.



Calculate the area of the rectangle shown opposite.



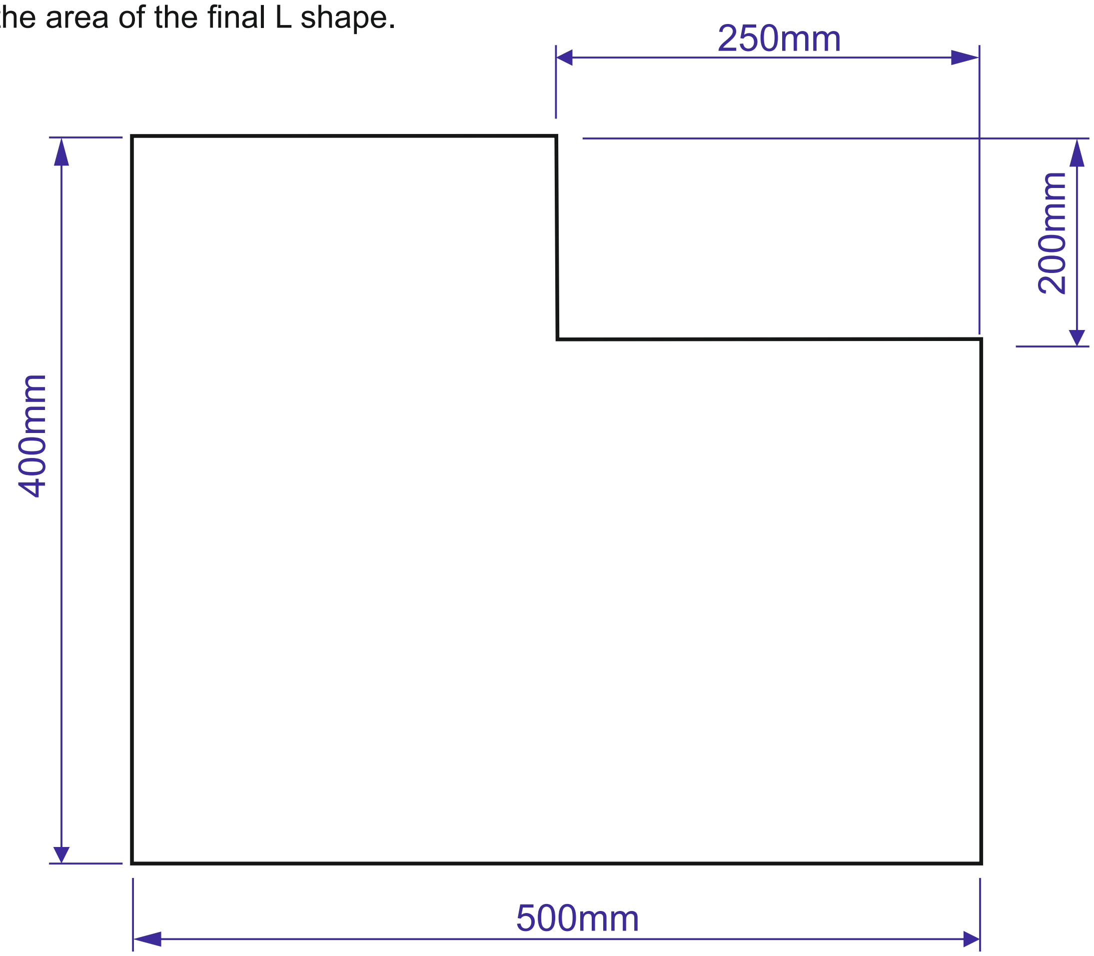
Calculate the area of the rectangle shown opposite.

AREA OF A RECTANGLE - EXAMINATION QUESTION

An acrylic panel for a storage unit is seen below.

1. Calculate the area of the acrylic required, before it is cut to shape (the overall rectangle of acrylic required, before it is cut to an L shape).

2. Calculate the area of the final L shape.



First, calculate the area of the uncut acrylic, by treating it as a rectangle 500mm x 400mm.

AREA = LENGTH X HEIGHT
AREA = 500 X 400
AREA = 200000mm²

Now, calculate the area of the smaller rectangular piece to be cut away, during the shaping of the panel

AREA = LENGTH X HEIGHT
AREA = 250 X 200
AREA = 50000mm²

Now subtract the smaller area from the area of the uncut plywood.

200000 - 50000 = 150000

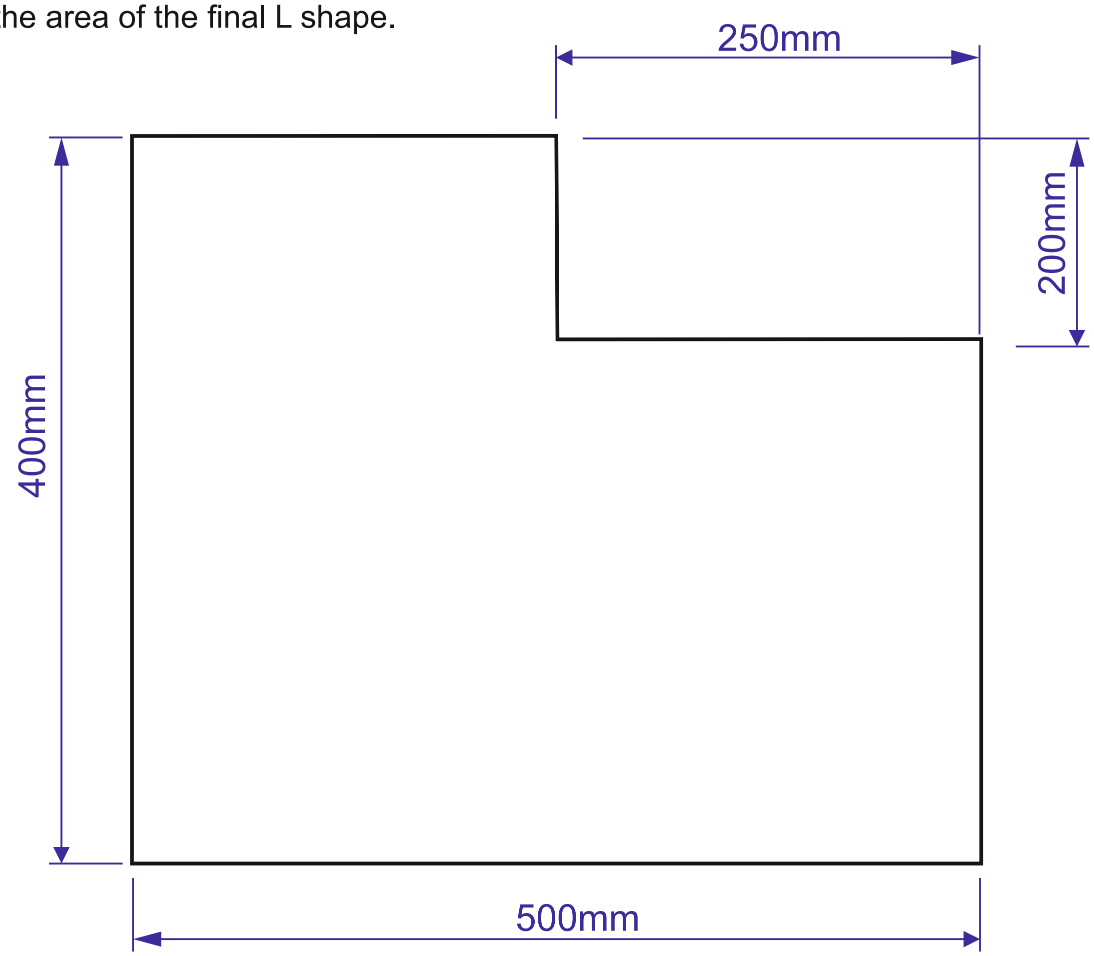
AREA OF FINAL SHAPED PIECE IS 150000mm²

AREA OF A RECTANGLE - EXAMINATION QUESTION

An acrylic panel for a storage unit is seen below.

1. Calculate the area of the acrylic required, before it is cut to shape (the overall rectangle of acrylic required, before it is cut to an L shape).

2. Calculate the area of the final L shape.

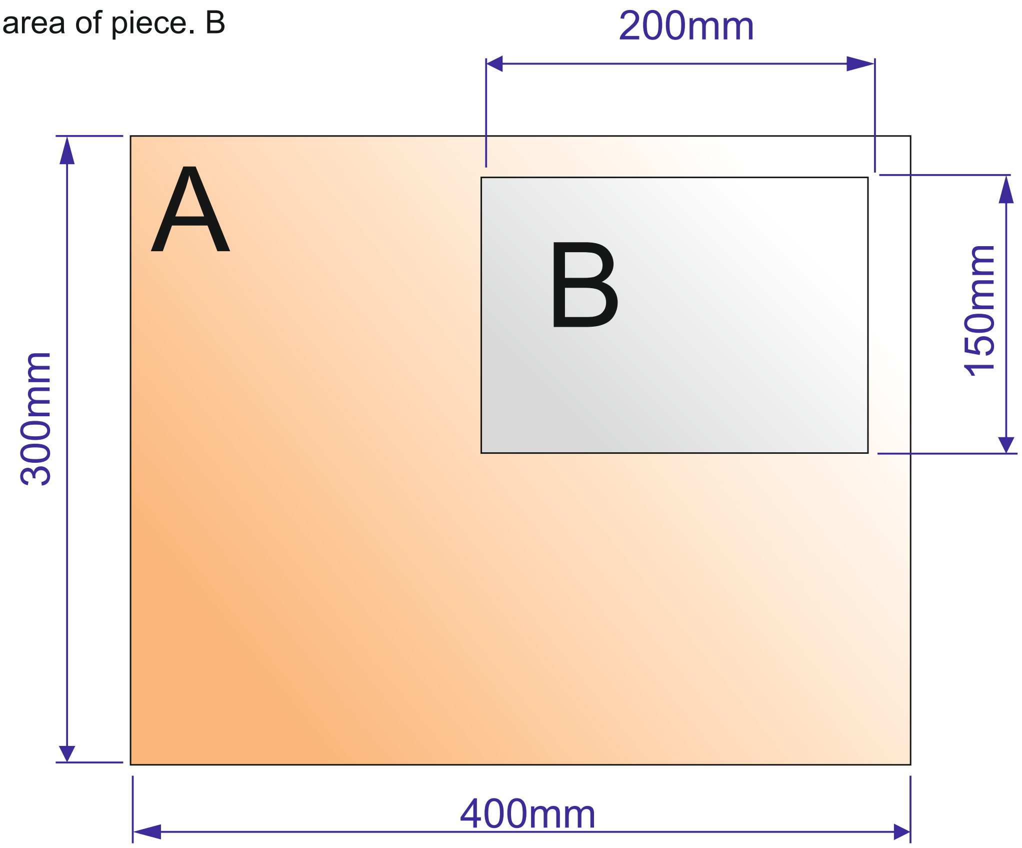


AREA OF A RECTANGLE - EXAMINATION QUESTION

A rectangular acrylic window for an Art project seen below, is composed of two rectangular pieces, accurately cut to size on a laser cutter. They fit perfectly together.

1. Calculate the area of piece A

2. Calculate the area of piece. B



First, calculate the entire area of 'A', without the smaller piece being removed, by treating it as a rectangle 400mm x 300mm.

AREA = LENGTH X HEIGHT
AREA = 400 X 300
AREA = 120000mm²

Now, calculate the area of the smaller rectangular piece 'B', *which is also the size of the piece to be removed from 'A'.*

AREA = LENGTH X HEIGHT
AREA = 200 X 150
AREA = 30000mm²

Now subtract the smaller rectangular area 'B' from the total area of rectangle 'A'. The answer will be the area of 'A', with the smaller rectangle of waste acrylic being removed.

120000 - 30000 = 90000mm²

AREA OF FINAL SHAPED PIECE 'A' WITHOUT THE SMALLER PIECE IS 90000mm²

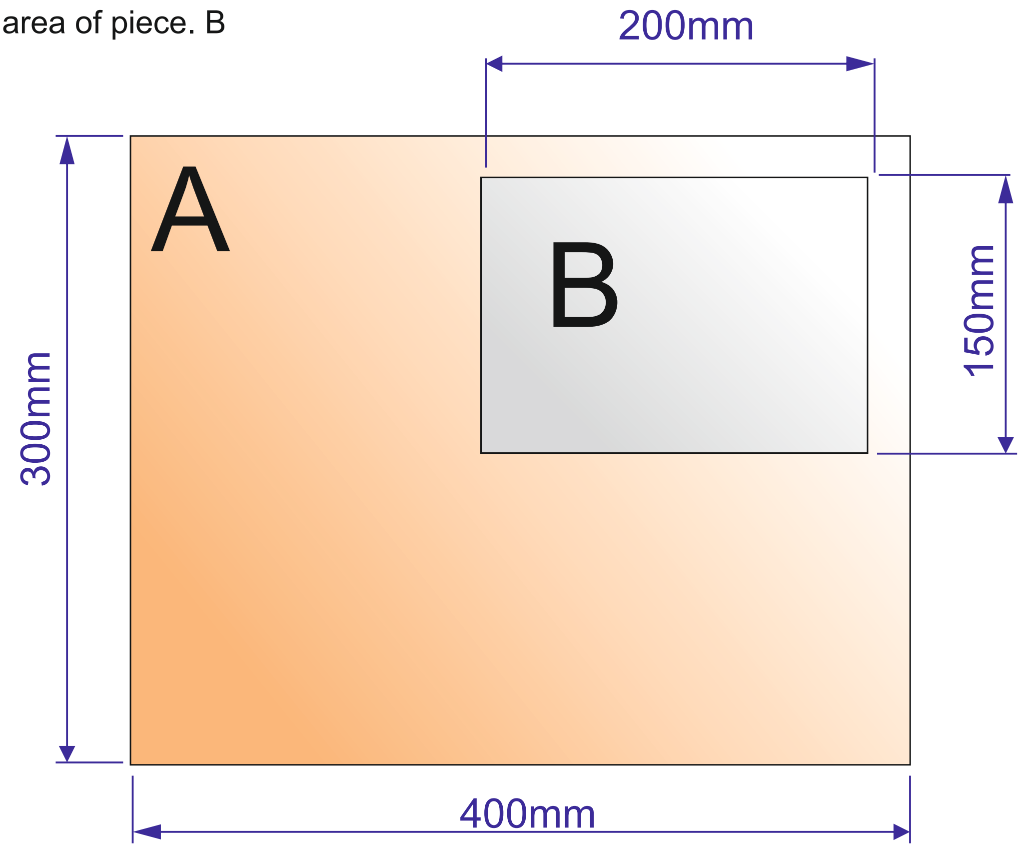
AREA OF PIECE 'B' IS 30000mm²

AREA OF A RECTANGLE - EXAMINATION QUESTION

A rectangular acrylic window for an Art project seen below, is composed of two rectangular pieces, accurately cut to size on a laser cutter. They fit perfectly together.

1. Calculate the area of piece A

2. Calculate the area of piece. B



MATHEMATICAL SKILLS

AREA AND CIRCUMFERENCE OF A CIRCLE
AND
ASSOCIATED EXAMINATION QUESTIONS

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DESIGN AND TECHNOLOGY

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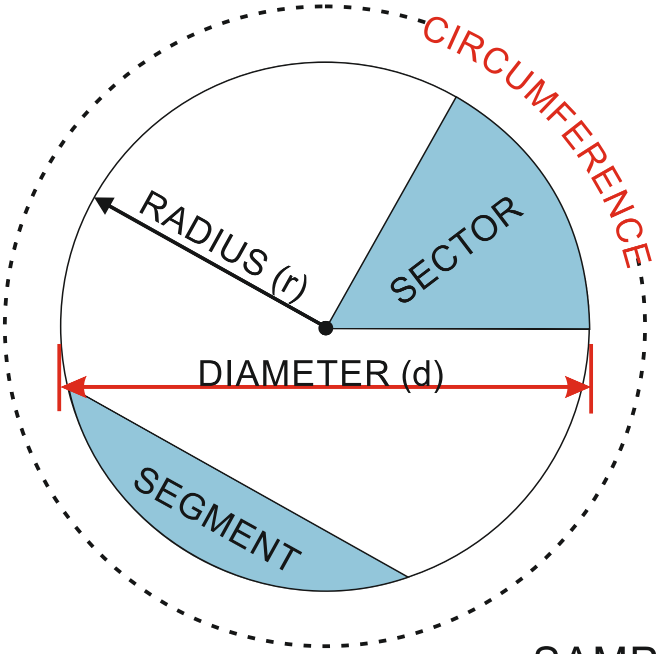
CALCULATING THE AREA OF A CIRCLE GIVEN THE RADIUS

Definition: A precise curve around a centre. Any point on the curve is an equal distance from the centre. A circle is composed of a circumference (the precise curve) and a diameter and radius.



FORMULA

$$AREA = \pi r^2$$

$$\pi \text{ (pi)} = 3.14$$

SAMPLE QUESTIONS

A circle has a radius of 100mm. What is the area of the circle?

$AREA = \pi r^2$ $\quad \pi$ (pi) = 3.14

$AREA = 3.14 \times (100 \times 100)$

$AREA = 3.14 \times (10000)$

$AREA = 31400mm^2$

A circle has a radius of 60mm. What is the area of the circle?

$AREA = \pi r^2$ $\quad \pi$ (pi) = 3.14

$AREA = 3.14 \times (60 \times 60)$

$AREA = 3.14 \times (3600)$

$AREA = 11304mm^2$

A circle has a radius of 80mm. What is the area of the circle?

$AREA = \pi r^2$ $\quad \pi$ (pi) = 3.14

$AREA = 3.14 \times (80 \times 80)$

$AREA = 3.14 \times (6400)$

$AREA = 20096mm^2$

AREA OF A CIRCLE - SAMPLE QUESTIONS

A circle has a radius of 30mm. What is the area of the circle?

AREA = πr^2 π (pi) = 3.14

AREA = 3.14 x (30 x 30)

AREA = 3.14 x (900)

AREA = 2826mm²

A circle has a radius of 40mm. What is the area of the circle?

AREA = πr^2 π (pi) = 3.14

AREA = 3.14 x (40 x 40)

AREA = 3.14 x (1600)

AREA = 5024mm²

A circle has a radius of 75mm. What is the area of the circle?

AREA = πr^2 π (pi) = 3.14

AREA = 3.14 x (75 x 75)

AREA = 3.14 x (5625)

AREA = 17662.5mm²

A circle has a radius of 45mm. What is the area of the circle?

AREA = πr^2 π (pi) = 3.14

AREA = 3.14 x (45 x 45)

AREA = 3.14 x (2025)

AREA = 6358.5mm²

A circle has a radius of 90mm. What is the area of the circle?

AREA = πr^2 π (pi) = 3.14

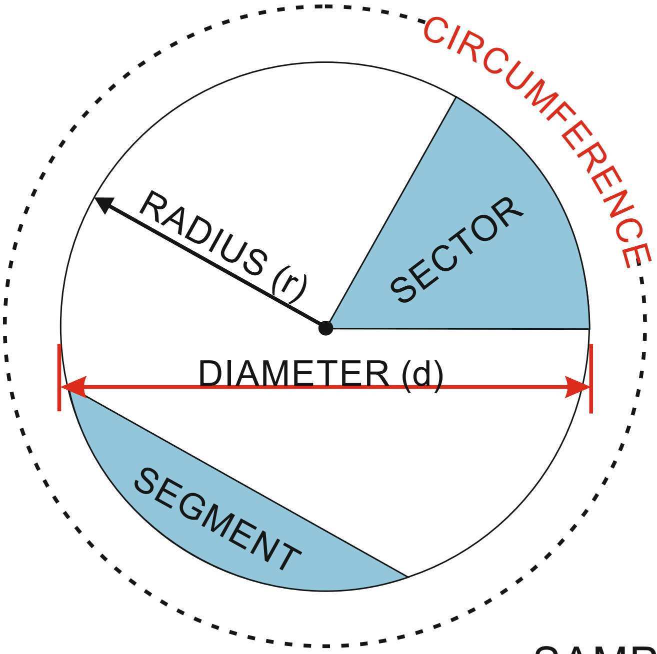
AREA = 3.14 x (90 x 90)

AREA = 3.14 x (8100)

AREA = 25434mm²

CALCULATING THE AREA OF A CIRCLE GIVEN THE RADIUS

Definition: A precise curve around a centre. Any point on the curve is an equal distance from the centre. A circle is composed of a circumference (the precise curve) and a diameter and radius.



FORMULA

$$AREA = \pi r^2$$

$$\pi \text{ (pi)} = 3.14$$

SAMPLE QUESTIONS

A circle has a radius of 100mm. What is the area of the circle?

$AREA = \pi r^2$ π (pi) = 3.14

A circle has a radius of 60mm. What is the area of the circle?

$AREA = \pi r^2$ π (pi) = 3.14

A circle has a radius of 80mm. What is the area of the circle?

$AREA = \pi r^2$ π (pi) = 3.14

AREA OF A CIRCLE - SAMPLE QUESTIONS

A circle has a radius of 30mm. What is the area of the circle?

AREA = πr^2 π (pi) = 3.14

A circle has a radius of 40mm. What is the area of the circle?

AREA = πr^2 π (pi) = 3.14

A circle has a radius of 75mm. What is the area of the circle?

AREA = πr^2 π (pi) = 3.14

A circle has a radius of 45mm. What is the area of the circle?

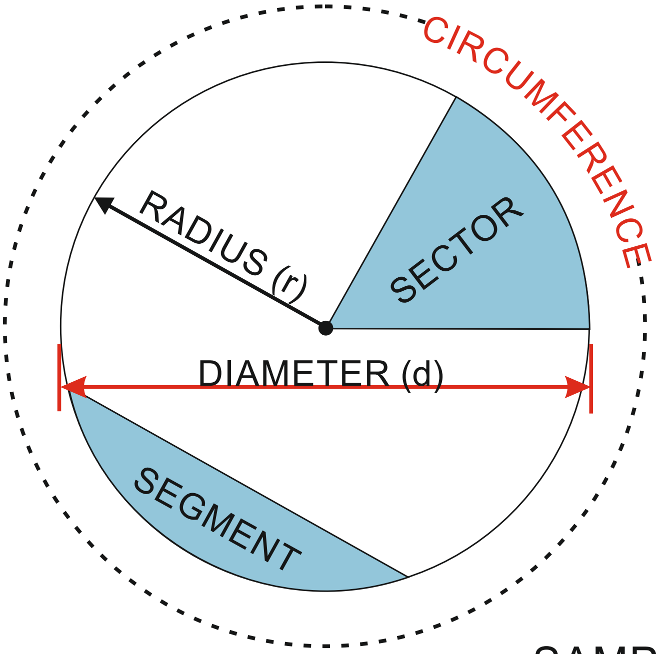
AREA = πr^2 π (pi) = 3.14

A circle has a radius of 90mm. What is the area of the circle?

AREA = πr^2 π (pi) = 3.14

CALCULATING THE CIRCUMFERENCE OF A CIRCLE GIVEN THE RADIUS

Definition: The circumference of a circle is the measurement of the boundary, all the way round, 360 degrees.



FORMULA

CIRCUMFERENCE = 2 x π x r

π (pi) = 3.14

SAMPLE QUESTIONS

A circle has a radius of 100mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

C = 2 x π x r

C = 2 x 3.14 x 100

C = 628mm

A circle has a radius of 60mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

C = 2 x π x r

C = 2 x 3.14 x 60

C = 376.8mm

A circle has a radius of 80mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

C = 2 x π x r

C = 2 x 3.14 x 80

C = 502.4mm

CIRCUMFERENCE - SAMPLE QUESTIONS

A circle has a radius of 30mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

C = 2 x π x r

C = 2 x 3.14 x 30

C = 188.4mm

A circle has a radius of 40mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

C = 2 x π x r

C = 2 x 3.14 x 40

C = 251.2mm

A circle has a radius of 75mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

C = 2 x π x r

C = 2 x 3.14 x 75

C = 471mm

A circle has a radius of 45mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

C = 2 x π x r

C = 2 x 3.14 x 45

C = 282.6mm

A circle has a radius of 90mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

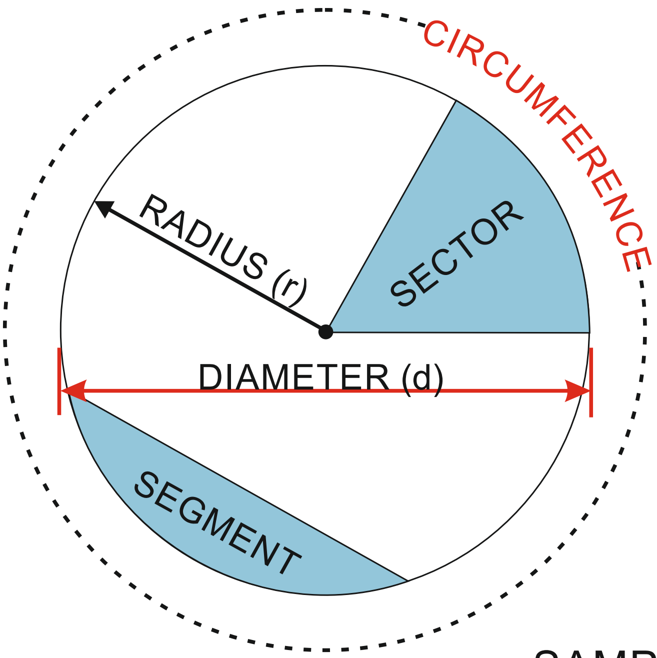
C = 2 x π x r

C = 2 x 3.14 x 90

C = 565.2mm

CALCULATING THE CIRCUMFERENCE OF A CIRCLE GIVEN THE RADIUS

Definition: The circumference of a circle is the measurement of the boundary, all the way round, 360 degrees.



FORMULA

CIRCUMFERENCE = 2 x π x r

π (pi) = 3.14

SAMPLE QUESTIONS

A circle has a radius of 100mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

A circle has a radius of 60mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

A circle has a radius of 80mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

CIRCUMFERENCE - SAMPLE QUESTIONS

A circle has a radius of 30mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

A circle has a radius of 40mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

A circle has a radius of 75mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

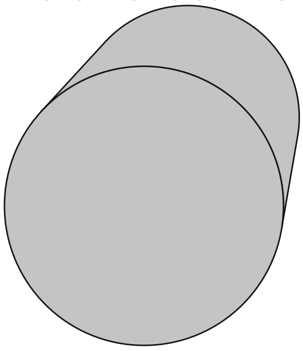
A circle has a radius of 45mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

A circle has a radius of 90mm. What is the circumference?

CIRCUMFERENCE = 2 x π x r

CIRCLE AREA AND CIRCUMFERENCE EXAMINATION QUESTIONS



The round section mild steel bar seen opposite, has a radius of 65mm.

What is the area of the ‘circle’ at one end?

What is the circumference of the round section bar?

FORMULA

AREA = πr^2

π (pi) = 3.14

AREA = 3.14 x (65 x 65)

AREA = 3.14 x (4225)

AREA = 13266.5mm²

FORMULA

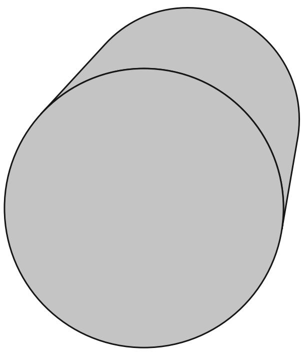
CIRCUMFERENCE = 2 x π x r

π (pi) = 3.14

C = 2 x π x r

C = 2 x 3.14 x 65

C = 408.2mm



The round section mild steel bar seen opposite, has a radius of 110mm.

What is the area of the ‘circle’ at one end?

What is the circumference of the round section bar?

FORMULA

AREA = πr^2

π (pi) = 3.14

AREA = 3.14 x (110 x 110)

AREA = 3.14 x (12100)

AREA = 37994mm²

FORMULA

CIRCUMFERENCE = 2 x π x r

π (pi) = 3.14

C = 2 x π x r

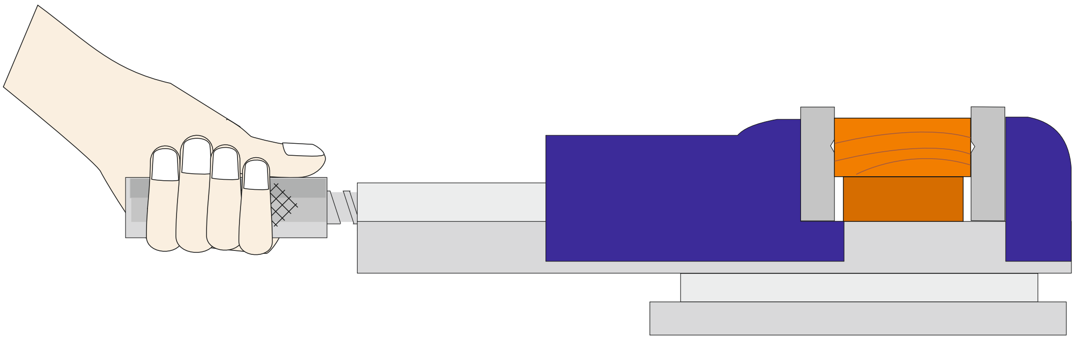
C = 2 x 3.14 x 110

C = 690.8mm

CIRCLE AREA AND CIRCUMFERENCE EXAMINATION QUESTIONS

A student is trying to work the ergonomic dimensions (measurements) for the 'round' handle of a machine vice, that he intends to manufacture. The student measures the radius of the handle of an existing handle and finds it to be 25mm.

What is the circumference of the handle?
What is the area of the 'round' end of the handle?



FORMULA

AREA = πr^2

π (pi) = 3.14

AREA = 3.14 x (25 x 25)

AREA = 3.14 x (625)

AREA = 1962.5mm²

FORMULA

CIRCUMFERENCE = 2 x π x r

π (pi) = 3.14

C = 2 x π x r

C = 2 x 3.14 x 25

C = 157mm

	RADIUS
HANDLE 1	20
HANDLE 2	25
HANDLE 3	24
HANDLE 4	30
HANDLE 5	28
TOTAL	*127*
AVERAGE	*25.4mm*

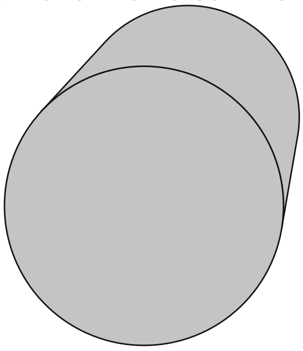
The student collects the radius measurements of five machine vices and enters the data into a table of results, seen opposite.

Calculate the average radius and enter your result in the table

Why could this measurement be useful when designing a new machine vice, based on the design above?

The measurement could be applied to the new design of the machine vice handle. Using the average radius measurement should mean that the handle is a good ergonomic 'fit' for the majority of users.

CIRCLE AREA AND CIRCUMFERENCE EXAMINATION QUESTIONS



The round section mild steel bar seen opposite, has a radius of 65mm.

What is the area of the 'circle' at one end?

What is the circumference of the round section bar?

FORMULA

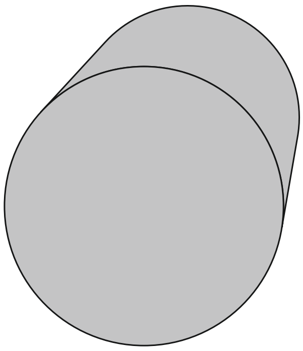
AREA = πr^2

π (pi) = 3.14

FORMULA

CIRCUMFERENCE = 2 x π x r

π (pi) = 3.14



The round section mild steel bar seen opposite, has a radius of 110mm.

What is the area of the 'circle' at one end?

What is the circumference of the round section bar?

FORMULA

AREA = πr^2

π (pi) = 3.14

FORMULA

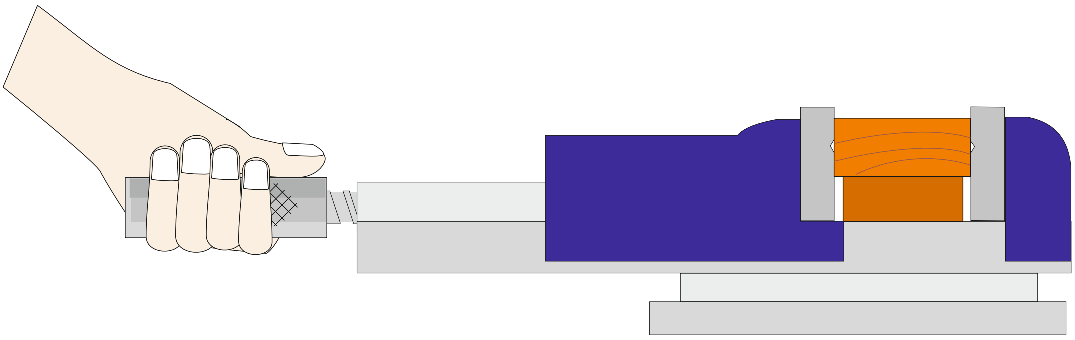
CIRCUMFERENCE = 2 x π x r

π (pi) = 3.14

CIRCLE AREA AND CIRCUMFERENCE EXAMINATION QUESTIONS

A student is trying to work the ergonomic dimensions (measurements) for the 'round' handle of a machine vice, that he intends to manufacture. The student measures the radius of the handle of an existing handle and finds it to be 25mm.

What is the circumference of the handle?
What is the area of the 'round' end of the handle?



FORMULA

AREA = πr^2

π (pi) = 3.14

FORMULA

CIRCUMFERENCE = $2 \times \pi \times r$

π (pi) = 3.14

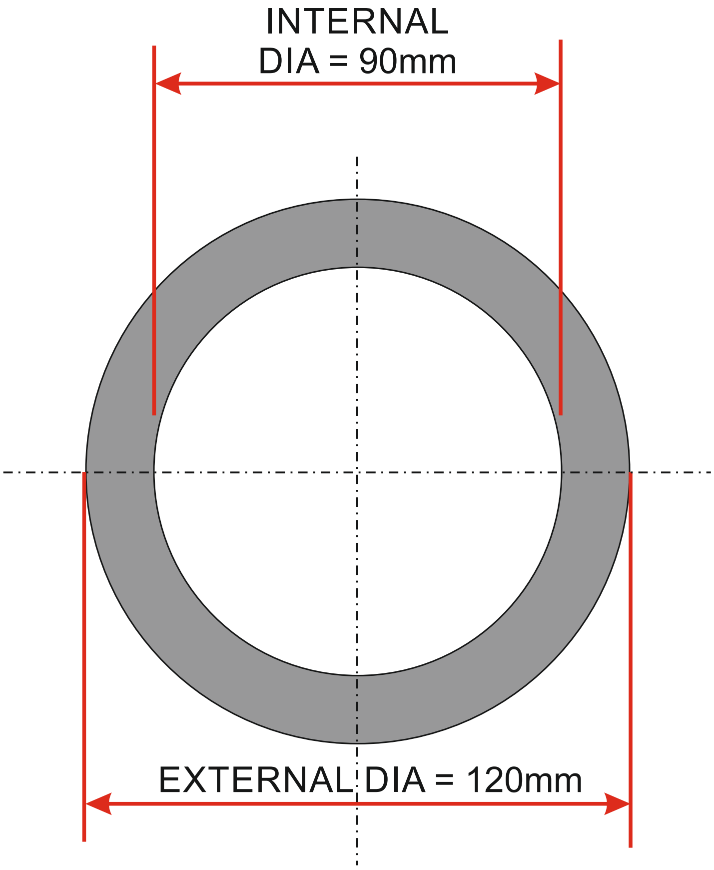
	RADIUS
HANDLE 1	20
HANDLE 2	25
HANDLE 3	24
HANDLE 4	30
HANDLE 5	28
TOTAL	*127*
AVERAGE	*25.4mm*

The student collects the radius measurements of five machine vices and enters the data into a table of results, seen opposite.

Calculate the average radius and enter your result in the table

Why could this measurement be useful when designing a new machine vice, based on the design above?

CIRCLE AREA AND CIRCUMFERENCE EXAMINATION QUESTIONS



A piece of steel tube can be seen opposite. The external and internal diameters can be read from the diagram.

What is the area of the surface at one end of the steel?

FORMULA

AREA = πr^2

π (pi) = 3.14

Treat the surface at the end of the tube as two circles and find the area of each one:

EXTERNAL DIAMETER	INTERNAL DIAMETER
AREA = πr^2	AREA = πr^2
AREA = 3.14 x (60 x 60)	AREA = 3.14 x (45 x 45)
AREA = 3.14 x (3600)	AREA = 3.14 x (2025)
AREA = 11304mm²	AREA = 6358.5mm²

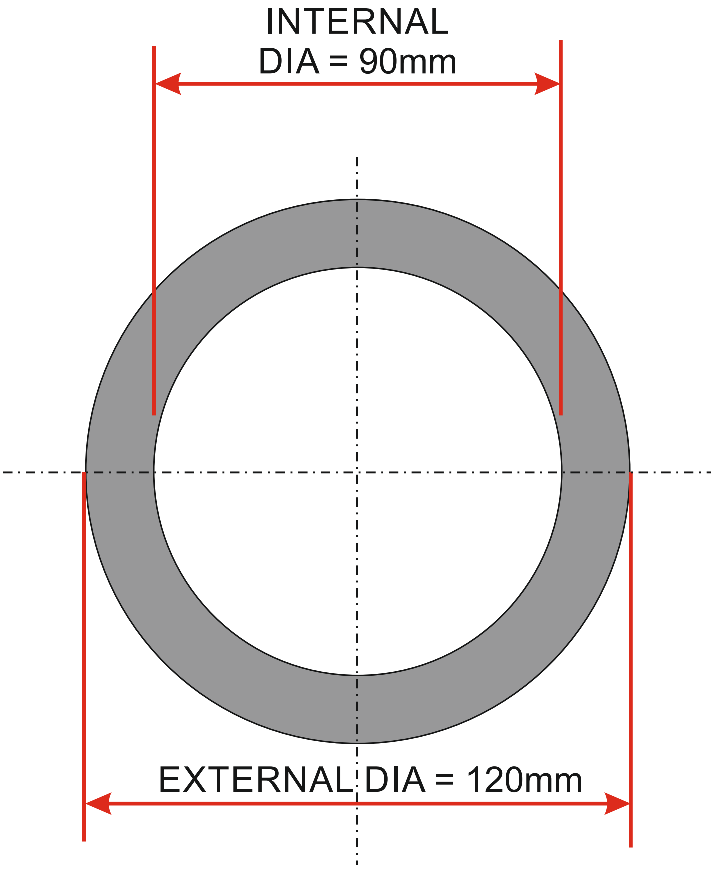
Then, subtract the area of the internal circle from the area of the external circle, to find the total surface area of the tube.

EXTERNAL CIRCLE	INTERNAL CIRCLE
11304mm²	6358.5mm²

11304 - 6358.5 = 4945.5mm²

The total surface area of one end of the tube is 4945.5mm²

CIRCLE AREA AND CIRCUMFERENCE EXAMINATION QUESTIONS



A piece of steel tube can be seen opposite. The external and internal diameters can be read from the diagram.

What is the area of the surface at one end of the steel?

FORMULA

$$AREA = \pi r^2$$

$$\pi \text{ (pi)} = 3.14$$

Treat the surface at the end of the tube as two circles and find the area of each one:

EXTERNAL DIAMETER	INTERNAL DIAMETER

Then, subtract the area of the internal circle from the area of the external circle, to find the total surface area of the tube.

The total surface area of one end of the tube is ______________

MATHEMATICAL SKILLS

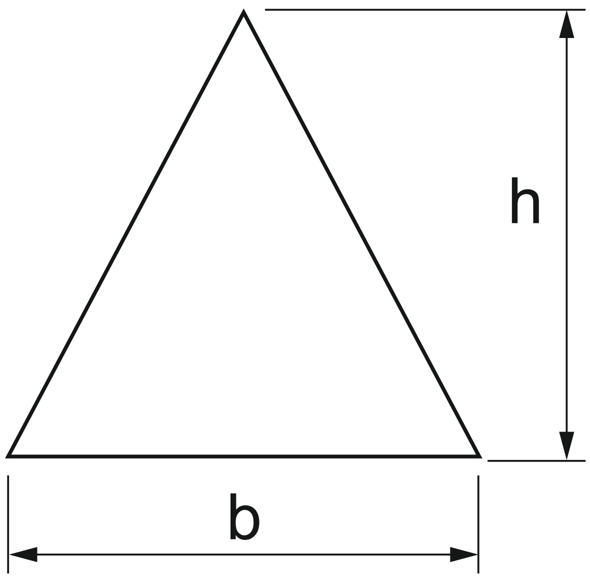
AREA OF A TRIANGLE
AND
ASSOCIATED EXAMINATION QUESTIONS

DESIGN AND TECHNOLOGY

WORLD ASSOCIATION OF TECHNOLOGY TEACHERS https://www.facebook.com/groups/254963448192823/ www.technologystudent.com © 2017 V.Ryan © 2017

CALCULATING THE AREA OF A TRIANGLE

Definition: A triangle can be regarded as a polygon with three sides.



FORMULA

AREA = 1/2 X BASE X HEIGHT

AREA = 1/2 b x h

$$\text{AREA} = \frac{b \times h}{2}$$

SAMPLE QUESTIONS

A triangle has a base of 60mm and a height of 80mm

AREA = 1/2 X BASE X HEIGHT

$$\text{AREA} = \frac{60 \times 80}{2}$$

$$\text{AREA} = \frac{4800}{2}$$

$$\text{AREA} = 2400\text{mm}^2$$

A triangle has a base of 40mm and a height of 50mm

AREA = 1/2 X BASE X HEIGHT

$$\text{AREA} = \frac{40 \times 50}{2}$$

$$\text{AREA} = \frac{2000}{2}$$

$$\text{AREA} = 1000\text{mm}^2$$

A triangle has a base of 70mm and a height of 90mm

AREA = 1/2 X BASE X HEIGHT

$$\text{AREA} = \frac{70 \times 90}{2}$$

$$\text{AREA} = \frac{6300}{2}$$

$$\text{AREA} = 3150\text{mm}^2$$

SAMPLE QUESTIONS

A triangle has a base of 100mm and a height of 120mm

$$AREA = 1/2 \times BASE \times HEIGHT$$

$$AREA = \frac{100 \times 120}{2}$$

$$AREA = \frac{12000}{2}$$

$$AREA = 6000mm^2$$

A triangle has a base of 75mm and a height of 50mm

$$AREA = 1/2 \times BASE \times HEIGHT$$

$$AREA = \frac{75 \times 50}{2}$$

$$AREA = \frac{3750}{2}$$

$$AREA = 1875mm^2$$

A triangle has a base of 45mm and a height of 55mm

$$AREA = 1/2 \times BASE \times HEIGHT$$

$$AREA = \frac{45 \times 55}{2}$$

$$AREA = \frac{2475}{2}$$

$$AREA = 1237.5mm^2$$

A triangle has a base of 110mm and a height of 130mm

$$AREA = 1/2 \times BASE \times HEIGHT$$

$$AREA = \frac{110 \times 130}{2}$$

$$AREA = \frac{14300}{2}$$

$$AREA = 7150mm^2$$

A triangle has a base of 300mm and a height of 400mm

$$AREA = 1/2 \times BASE \times HEIGHT$$

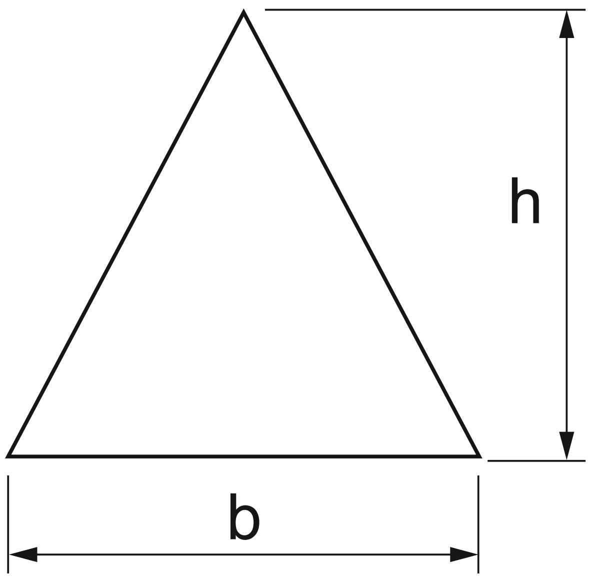
$$AREA = \frac{300 \times 400}{2}$$

$$AREA = \frac{120000}{2}$$

$$AREA = 60000mm^2$$

CALCULATING THE AREA OF A TRIANGLE

Definition: A triangle can be regarded as a polygon with three sides.



FORMULA

AREA = 1/2 X BASE X HEIGHT

AREA = 1/2 b x h

$$\text{AREA} = \frac{b \times h}{2}$$

SAMPLE QUESTIONS

A triangle has a base of 60mm and a height of 80mm

AREA = 1/2 X BASE X HEIGHT

A triangle has a base of 40mm and a height of 50mm

AREA = 1/2 X BASE X HEIGHT

A triangle has a base of 70mm and a height of 90mm

AREA = 1/2 X BASE X HEIGHT

SAMPLE QUESTIONS

A triangle has a base of 100mm and a height of 120mm

AREA = 1/2 X BASE X HEIGHT

A triangle has a base of 75mm and a height of 50mm

AREA = 1/2 X BASE X HEIGHT

A triangle has a base of 45mm and a height of 55mm

AREA = 1/2 X BASE X HEIGHT

A triangle has a base of 110mm and a height of 130mm

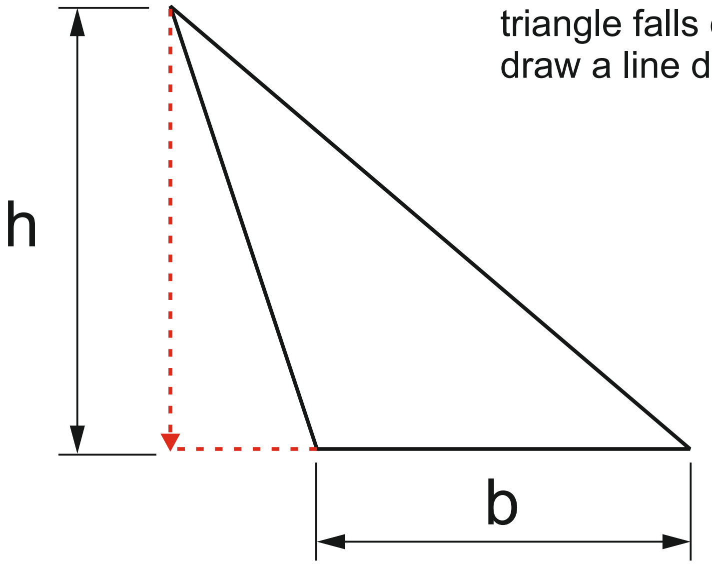
AREA = 1/2 X BASE X HEIGHT

A triangle has a base of 300mm and a height of 400mm

AREA = 1/2 X BASE X HEIGHT

WHAT HAPPENS WHEN THE 'HEIGHT' FALLS OUTSIDE THE BASE?

With an obtuse triangle, where the top (vertex) of the triangle falls outside the base, as seen opposite - simply draw a line down, as if with a plumb line.

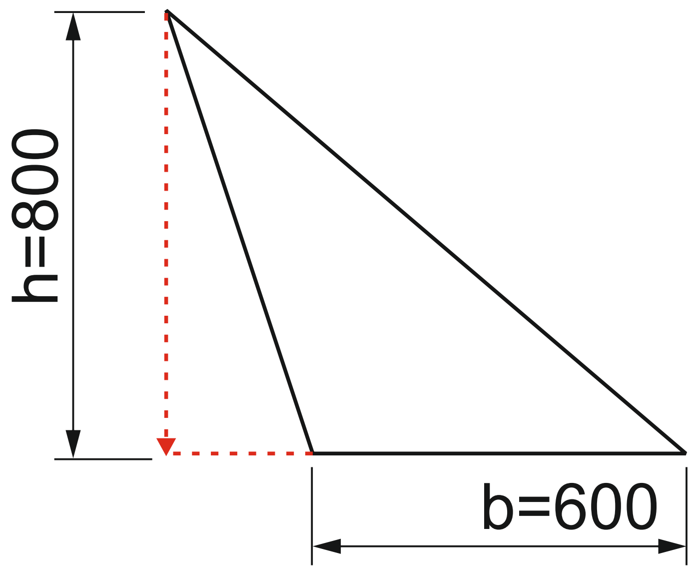


FORMULA - REMAINS THE SAME

AREA = 1/2 X BASE X HEIGHT

AREA = 1/2 b x h

$$\text{AREA} = \frac{b \times h}{2}$$



AREA = 1/2 X BASE X HEIGHT

$$\text{AREA} = \frac{600 \times 800}{2}$$

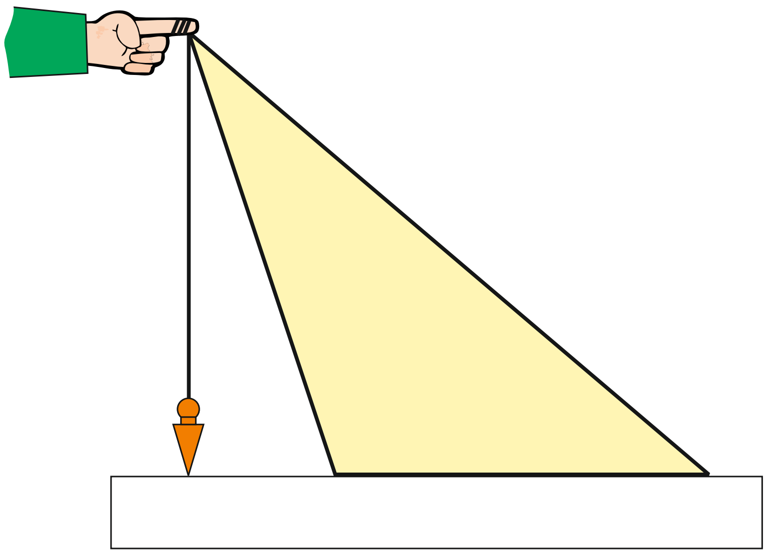
$$\text{AREA} = \frac{480000}{2}$$

$$\text{AREA} = 240000\text{mm}^2$$

PRACTICAL EXERCISE:

Cut a number of obtuse triangles from 'brown' box cardboard.

Then calculate the areas of each triangle, using a plumb line to work out the height.



PRACTICAL QUESTIONS

Measure the height of each cardboard obtuse triangle, with the aid of a plumb line. Then, use the formula AREA = 1/2 X BASE X HEIGHT, to calculate each area.

CARDBOARD TRIANGLE 1

AREA = 1/2 X BASE X HEIGHT

BASE=

HEIGHT=

CARDBOARD TRIANGLE 1

AREA = 1/2 X BASE X HEIGHT

BASE=

HEIGHT=

CARDBOARD TRIANGLE 1

AREA = 1/2 X BASE X HEIGHT

BASE=

HEIGHT=

CARDBOARD TRIANGLE 1

AREA = 1/2 X BASE X HEIGHT

BASE=

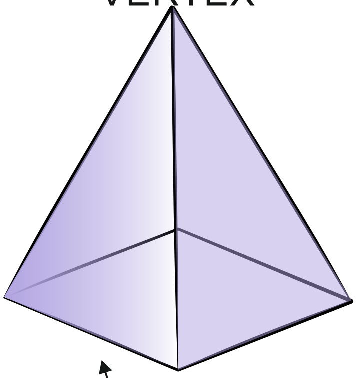
HEIGHT=

CARDBOARD TRIANGLE 1

AREA = 1/2 X BASE X HEIGHT

BASE=

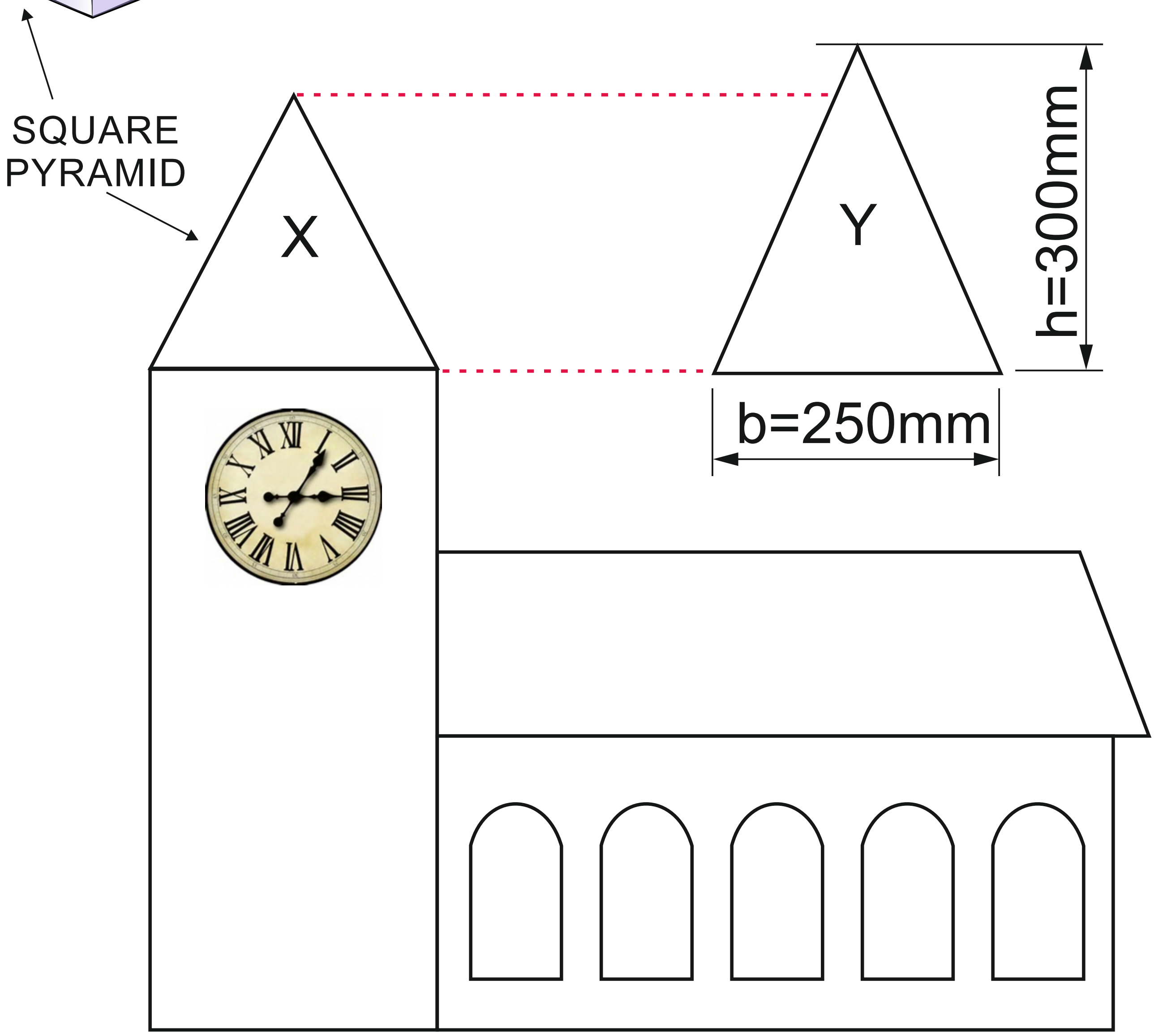
HEIGHT=



Below is a model a typical village church.

The roof of the tower is a square pyramid.

1. What is the area of one side of the square pyramid?



AREA = 1/2 X BASE X HEIGHT

$$\text{AREA} = \frac{250 \times 300}{2}$$

$$\text{AREA} = \frac{75000}{2}$$

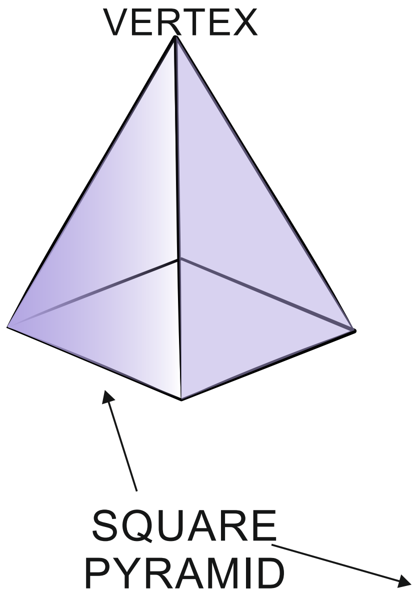
$$\text{AREA} = 37500\text{mm}^2$$

2. The labels X and Y represent the same part, one side of the square pyramid. Why does Y appear taller than X ?

'Y' appears taller than 'X', because each side of the square pyramid is tilted towards the pyramid's VERTEX, giving the appearance of it being shorter than it actually is.

'Y' is the side of the pyramid held perfectly straight upwards, not inclined / tilted towards the vertex. This gives us the actual 'true' shape of the triangle.

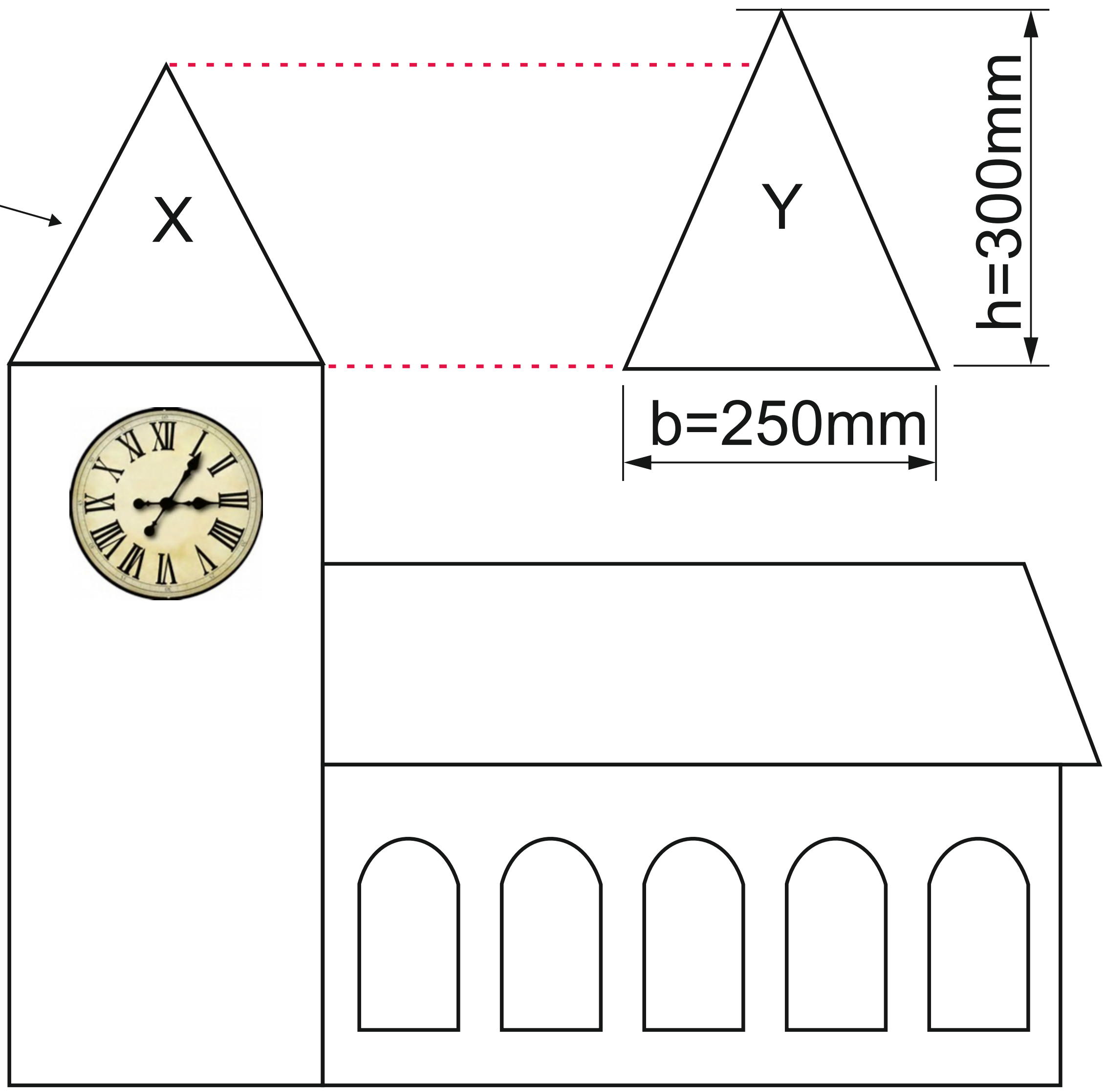
AREA OF A TRIANGLE - EXAMINATION QUESTIONS



Below is a model a typical village church.

The roof of the tower is a square pyramid.

1. What is the area of one side of the square pyramid?



AREA = 1/2 X BASE X HEIGHT

2. The labels X and Y represent the same part, one side of the square pyramid. Why does Y appear taller than X ?

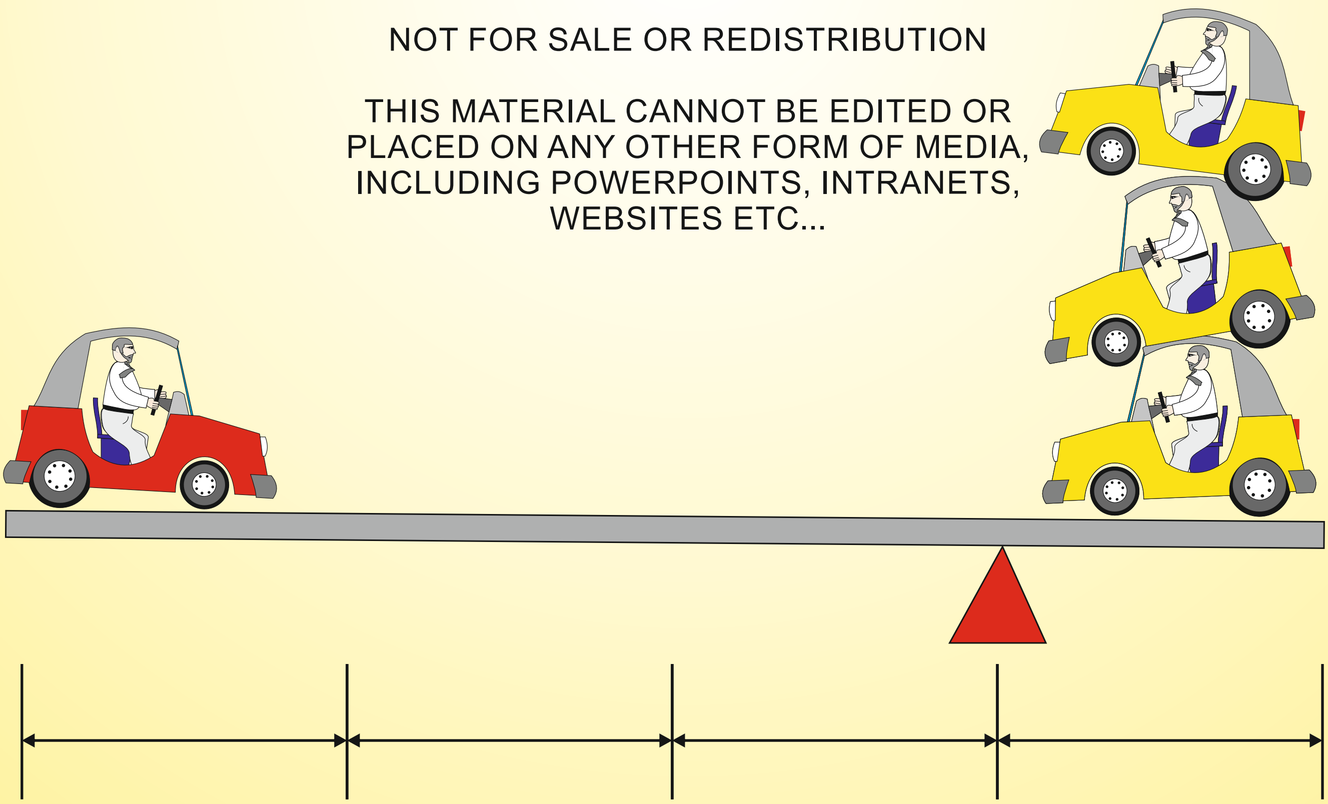
MATHEMATICAL SKILLS

MOMENTS OF FORCE (RATIOS) AND EQUILIBRIUM

AND

ASSOCIATED EXAMINATION QUESTIONS

DESIGN AND TECHNOLOGY



For animations to help explain Moments of Force and Equilibrium and questions and answers go to:

http://www.technologystudent.com/forcmom/force2.htm

For a PRACTICAL PROJECT on Equilibrium go to:

http://www.technologystudent.com/forcmom/cengrav1.html

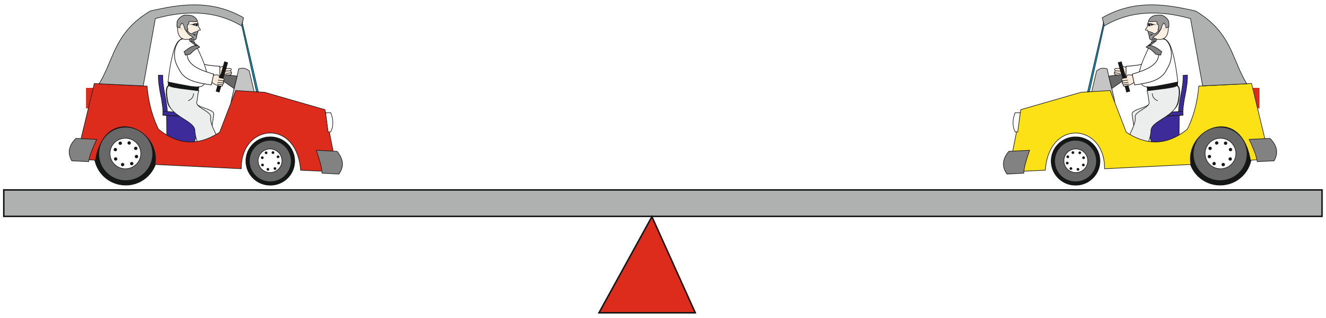
and

http://www.technologystudent.com/forcmom/balance1.html

MOMENTS OF FORCE AND EQUILIBRIUM

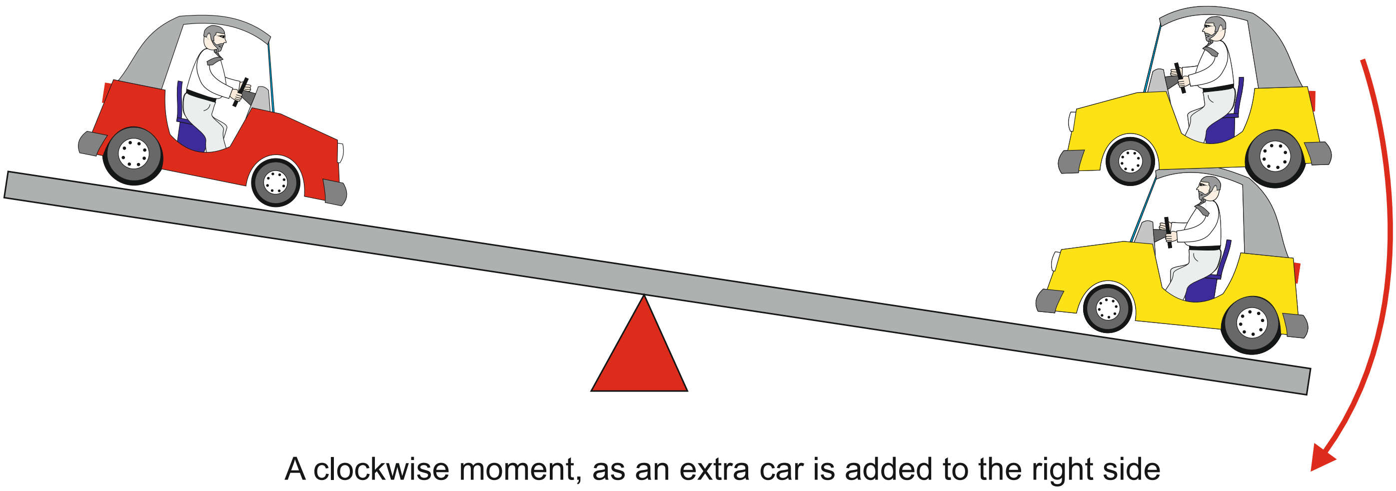
The diagram below clearly shows a state of equilibrium. The cars on either side of the seesaw are exactly the same in weight and height, in fact they are the same model. As a result, the seesaw stays level. The centre of the seesaw is called the 'fulcrum', seen here as a triangle and this is where the beam, that the cars rest on, tilts backwards and forwards. However, because of the state of equilibrium, they remain completely still.

The weight of the cars is called the effort.



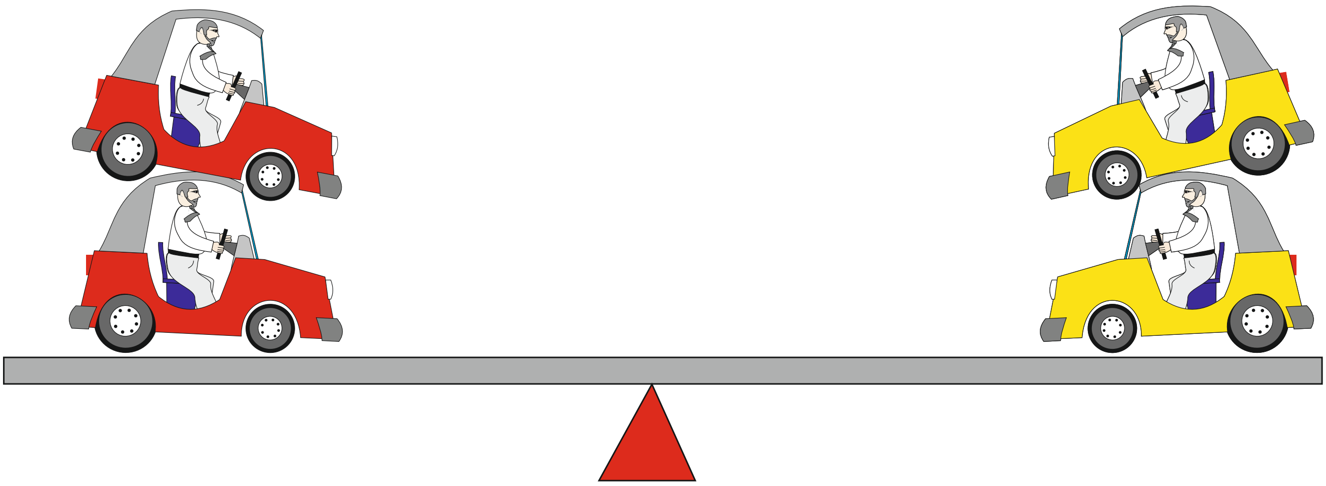
The cars are in a 'state of equilibrium' because the weight, on either side, is exactly the same. The distance from each car to the fulcrum, is also the same.

If an extra car is added to the right hand side (see diagram below), then the seesaw will turn in a clockwise direction - called a clockwise moment.
Alternatively, if more cars are added to the left hand side, the seesaw will turn in an anticlockwise direction - called an anticlockwise moment.

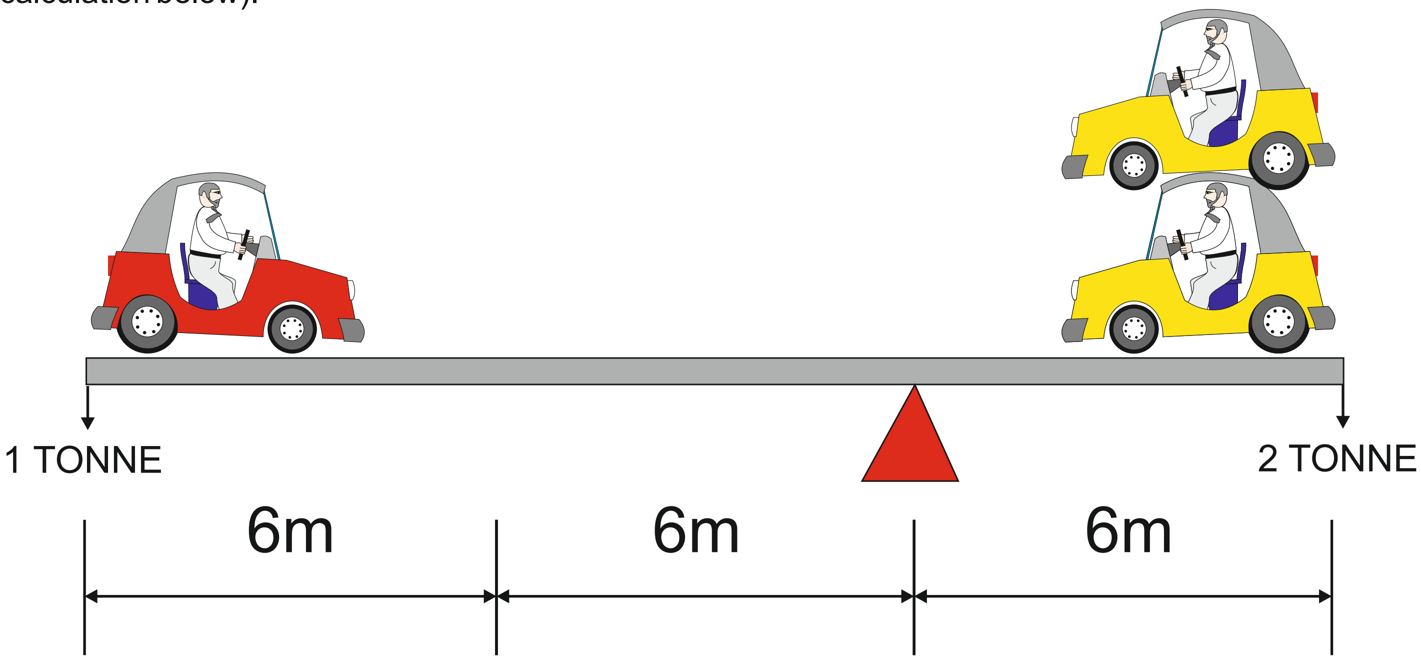


A clockwise moment, as an extra car is added to the right side

If the seesaw is to be in equilibrium, the clockwise moments must be equal to the anticlockwise moments. The seesaw is back in 'equilibrium' because a second car has been added to the left hand side, as well.



A state of equilibrium is also seen below. Each of the cars weighs the same (1 Tonne). Despite the fact that there is only one car on the left-hand side, the moments balance because, the car on the left-hand side, is twice the distance from the fulcrum, compared to the cars on the right-hand side. (see the calculation below).



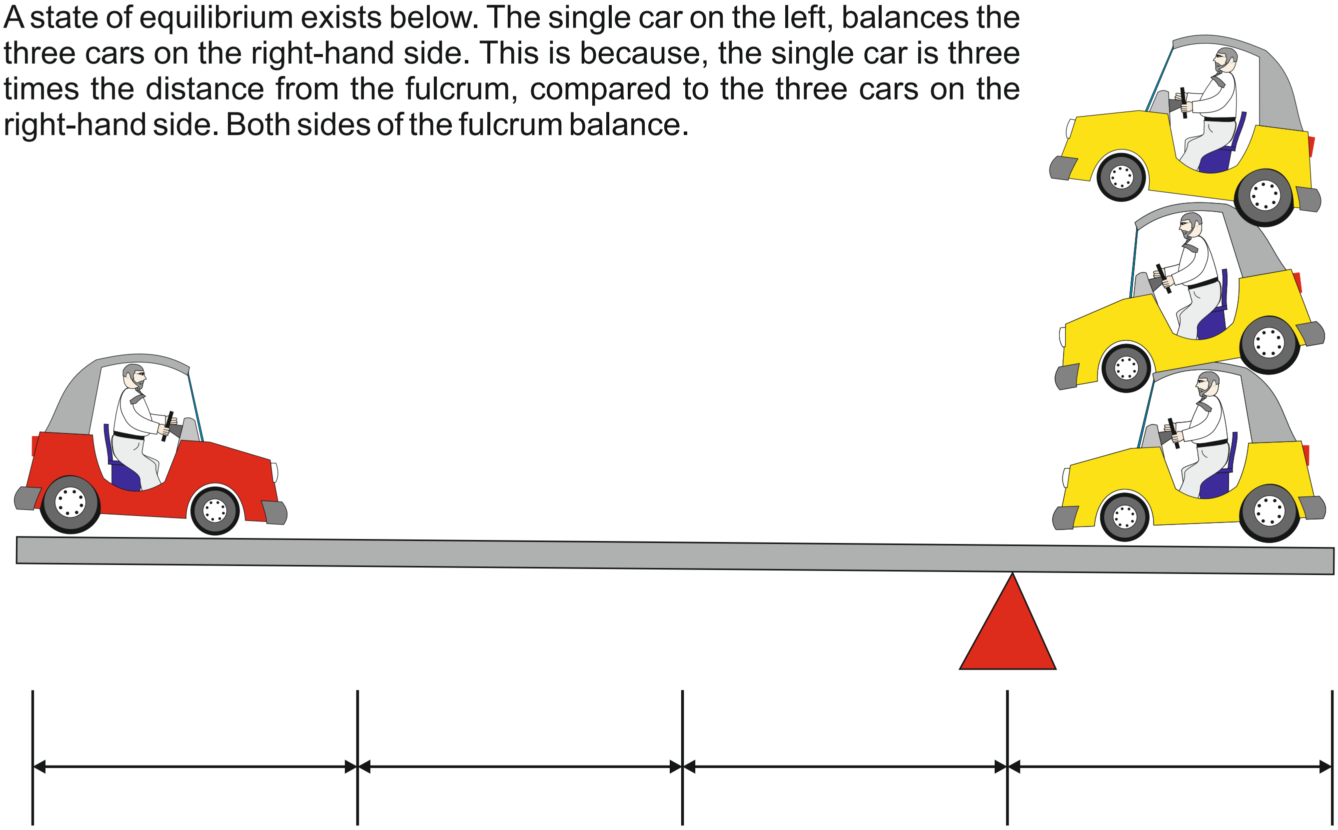
CLOCKWISE MOMENTS = ANTI-CLOCKWISE MOMENTS

1 TONNE X 12m = 2 TONNE x 6m

12 = 12

STATE OF EQUILIBRIUM

A state of equilibrium exists below. The single car on the left, balances the three cars on the right-hand side. This is because, the single car is three times the distance from the fulcrum, compared to the three cars on the right-hand side. Both sides of the fulcrum balance.

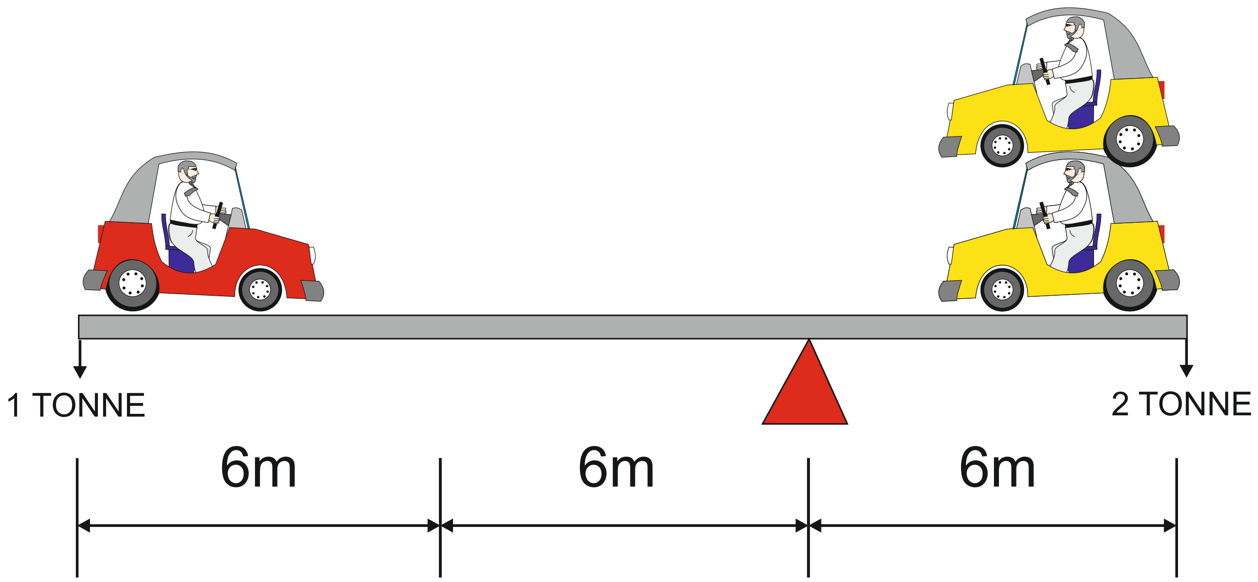


EXAMINATION QUESTION - MOMENTS OF FORCE AND EQUILIBRIUM

1. What is equilibrium? To answer this question you must complete the diagram below, clearly demonstrating 'equilibrium' and add explanatory notes.

What is the fulcrum?

Explain why the diagram below shows a state of equilibrium, especially as there appears to be an imbalance of two cars on the right, to one car on the left. You will need to include the correct calculation and notes in your answer.

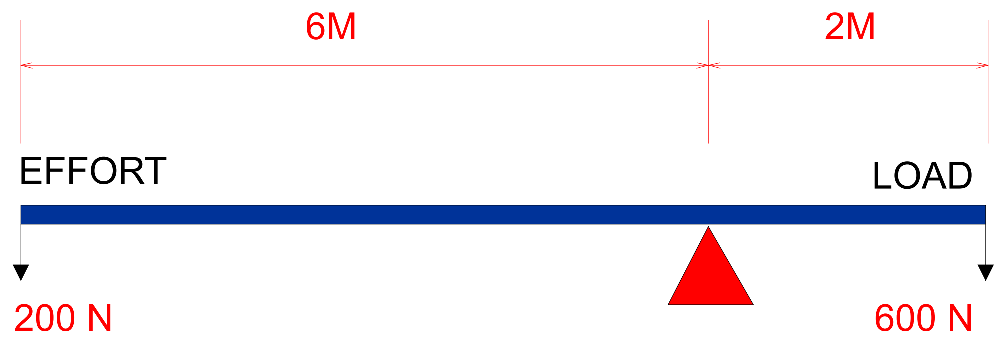


CALCULATION

NOTES/EXPLANATION

EXAMPLE EXAMINATION QUESTIONS AND ANSWERS

1. The diagram below shows a lever where an effort of 200 N balances a load of 600 N. The effort force is 6 metres from the fulcrum. The load force is two metres from the fulcrum.



Clockwise moment = 600 x 2 Nm

Anti-clockwise moment = 200 x 6 Nm

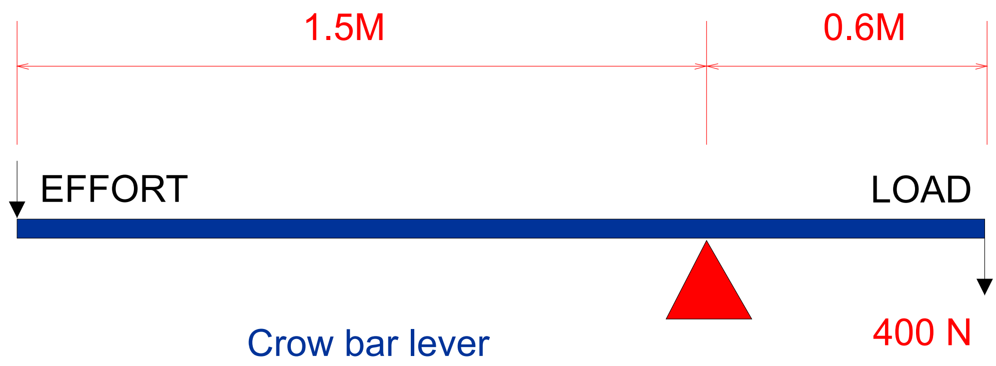
In a state of equilibrium,

clockwise moments = anti-clockwise moments

600 X 2 Nm = 200 x 6 Nm

1200 = 1200

2. In the diagram below a crow-bar is used to move a 400n load. What effort is required to move the load?



Clockwise moments = 400 N x 0.6 m

Anticlockwise moments = effort x 1.5m

In equilibrium;

clockwise moments = anti-clockwise moments

400 x 0.6 = effort x 1.5

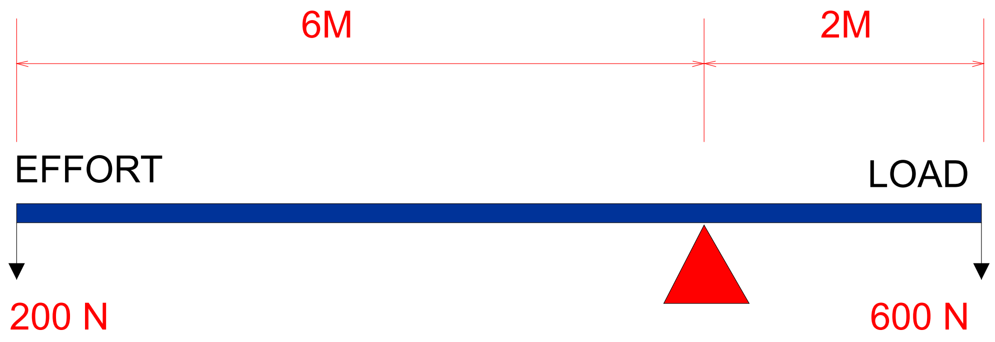
$$\text{effort} = \frac{400 \times 0.6}{1.5}$$

$$\text{effort} = \frac{240}{1.5}$$

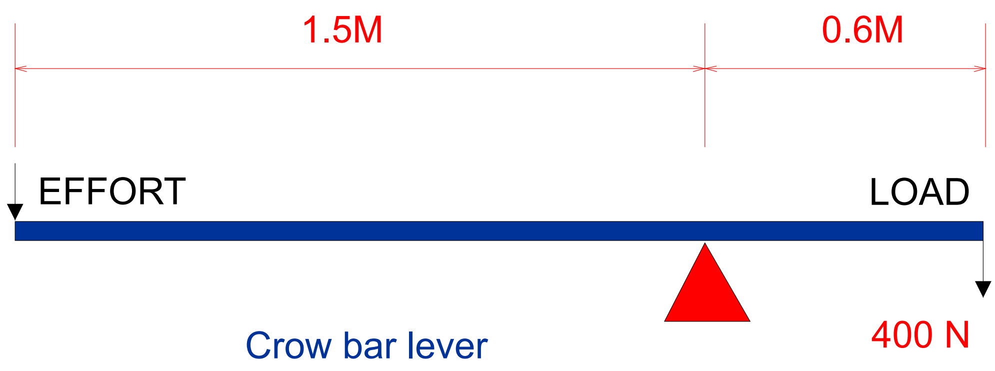
$$= 160\ \text{N}$$

EXAMPLE EXAMINATION QUESTIONS

1. The diagram below shows a lever, where an effort of 200 N balances a load of 600 N. Show how this is correct, by calculating the clockwise and anticlockwise moments.



2. In the diagram below, a crow-bar is used to move a 400n load. What effort is required to move the load?



EXAMPLE EXAMINATION QUESTIONS AND ANSWERS

3. Another crow-bar is used to lever a load of 120N. The load is 2m from the fulcrum and the effort is 6m from the fulcrum. What effort is required to move the load ?

Crow bar lever

Clockwise moments = 120 N x 2 m

Anticlockwise moments = effort x 6m

In equilibrium;

clockwise moments = anti-clockwise moments

120 x 2 = effort x 6

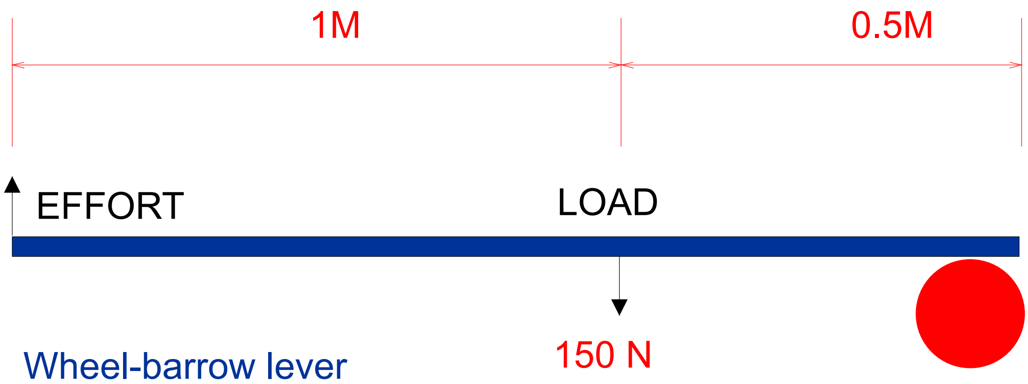
$$\text{effort} = \frac{120 \times 2}{6}$$

$$\text{effort} = \frac{240}{6}$$

$$= 40 \text{ N}$$

An effort of over **40 N** is required to move the load.

4. A wheel-barrow is used to lift a load of 150N. The wheel acts as the fulcrum. Calculate the effort required.



Wheel-barrow lever

Clockwise moments = 150 N x .5 m

Anticlockwise moments = effort x 1.5m

In equilibrium;

clockwise moments = anti-clockwise moments

150 x .5 = effort x 1.5

$$\text{effort} = \frac{150 \times .5}{1.5}$$

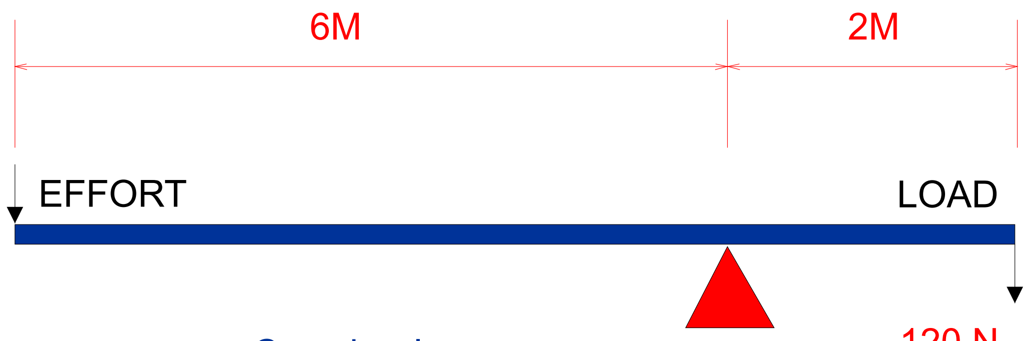
$$\text{effort} = \frac{75}{1.5}$$

$$= 50 \text{ N}$$

An effort of over **50 N** is required to lift the wheel-barrow.

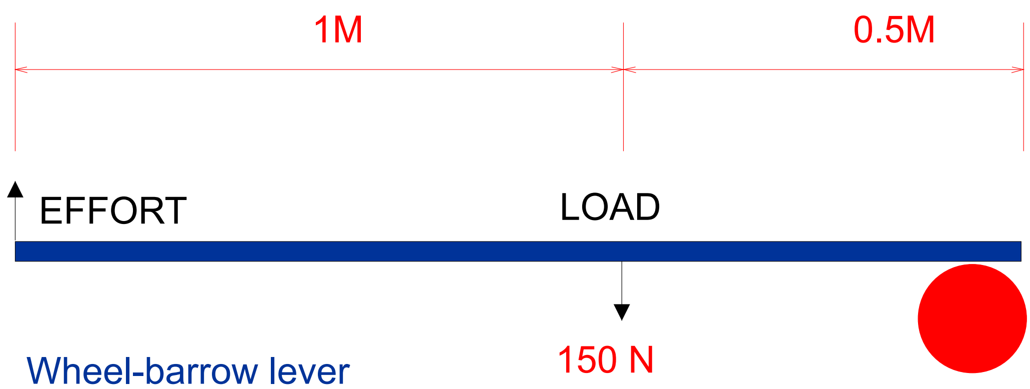
EXAMPLE EXAMINATION QUESTIONS

3. Another crow-bar is used to lever a load of 120N. The load is 2m from the fulcrum and the effort is 6m from the fulcrum. What effort is required to move the load ?



Crow bar lever

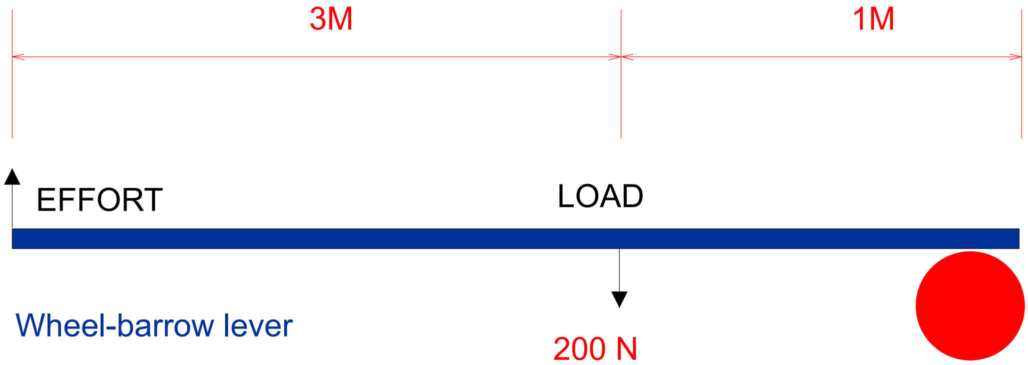
4. A wheel-barrow is used to lift a load of 150N. The wheel acts as the fulcrum. Calculate the effort required.



Wheel-barrow lever

EXAMPLE EXAMINATION QUESTIONS AND ANSWERS

5. A wheel-barrow is used to lift a load of 200N. The wheel acts as the fulcrum. Calculate the effort required.



Wheel-barrow lever

Clockwise moments = 200 N x 1 m

Anticlockwise moments = effort x 4m

In equilibrium;

clockwise moments = anti-clockwise moments

$$200 \times 1 = \text{effort} \times 4$$

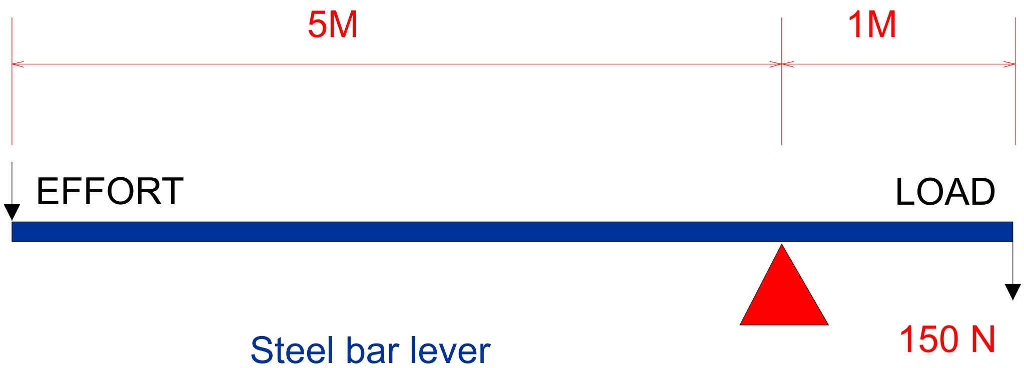
$$\text{effort} = \frac{200 \times 1}{4}$$

$$\text{effort} = \frac{200}{4}$$

$$= 50 \text{ N}$$

An effort of over **50 N** is required to lift the wheel-barrow.

6. A metal bar is used to lever a load of 150N. The load is 1m from the fulcrum and the effort is 5m from the fulcrum. What effort is required to move the load ?



Steel bar lever

Clockwise moments = 150 N x 1 m

Anticlockwise moments = effort x 5m

In equilibrium;

clockwise moments = anti-clockwise moments

$$150 \times 1 = \text{effort} \times 5$$

$$\text{effort} = \frac{150 \times 1}{5}$$

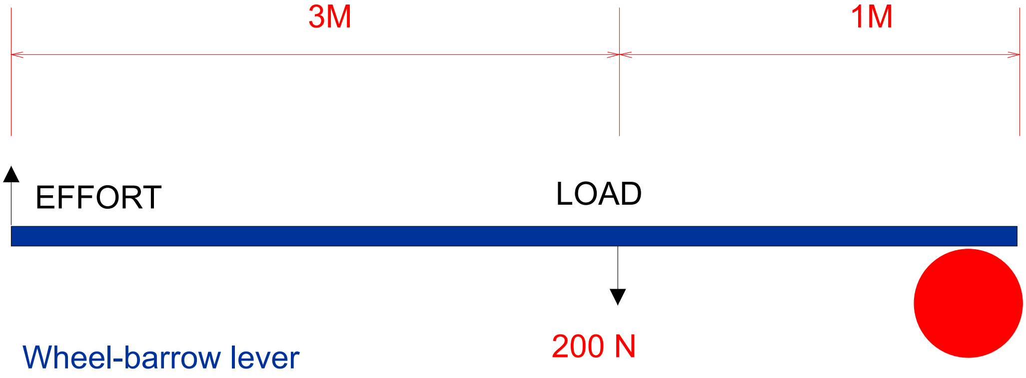
$$\text{effort} = \frac{150}{5}$$

$$= 30 \text{ N}$$

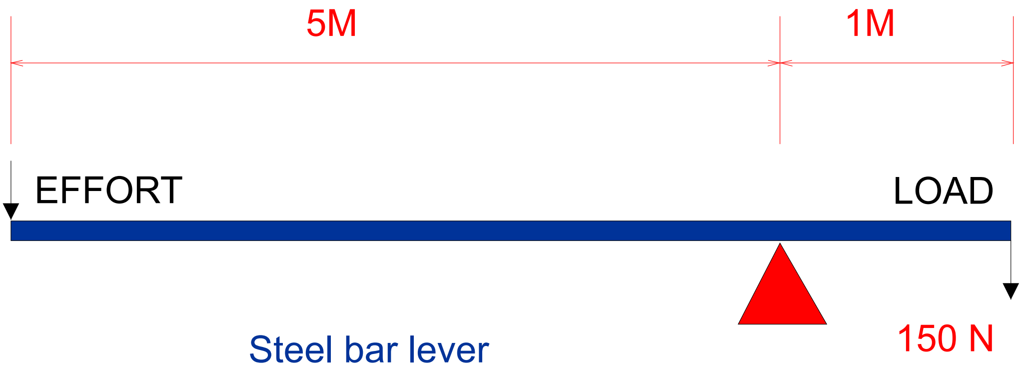
An effort of over **40 N** is required to move the load.

EXAMPLE EXAMINATION QUESTIONS

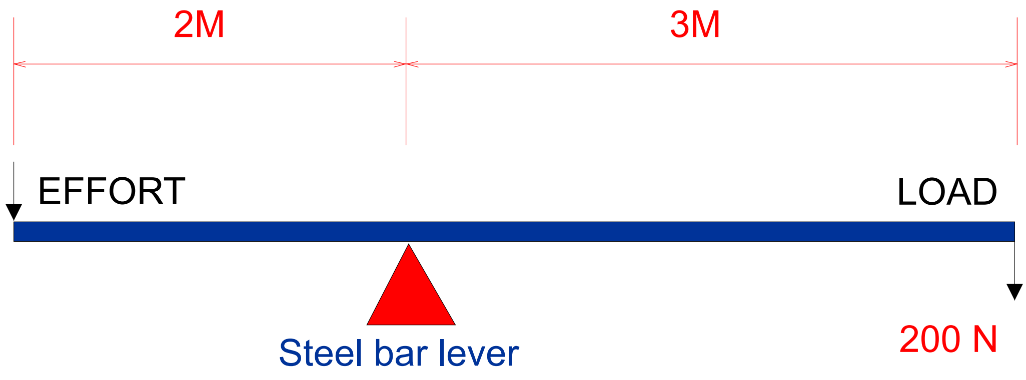
5. A wheel-barrow is used to lift a load of 200N. The wheel acts as the fulcrum. Calculate the effort required.



6. A metal bar is used to lever a load of 150N. The load is 1m from the fulcrum and the effort is 5m from the fulcrum. What effort is required to move the load ?



7. Another metal bar is used to lever a load of 200N. The load is 3m from the fulcrum and the effort is 2m from the fulcrum. What effort is required to move the load ?



Clockwise moments = 200 N x 3 m

Anticlockwise moments = effort x 2m

In equilibrium;

clockwise moments = anti-clockwise moments

200 x 3 = effort x 2

$$\text{effort} = \frac{200 \times 3}{2}$$

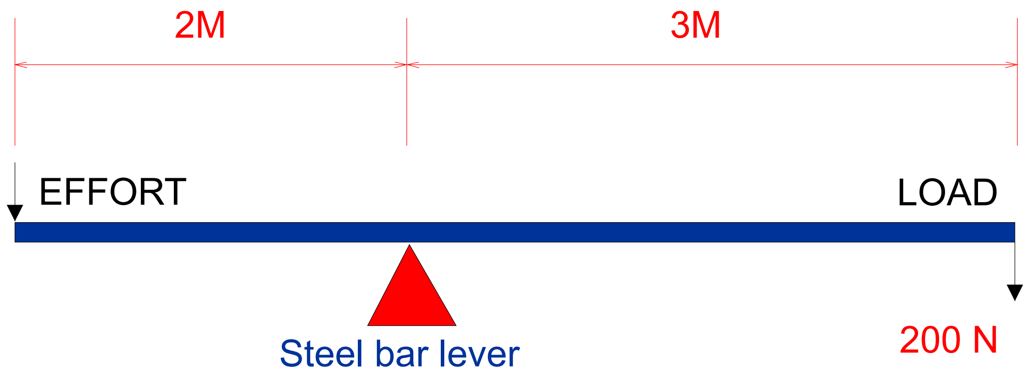
$$\text{effort} = \frac{600}{2}$$

= 300 N

An effort of over **300 N** is required to move the load.

EXAMPLE EXAMINATION QUESTIONS

7. Another metal bar is used to lever a load of 200N. The load is 3m from the fulcrum and the effort is 2m from the fulcrum. What effort is required to move the load ?



MATHEMATICAL SKILLS

RATIOS
AND
ASSOCIATED EXAMINATION QUESTIONS

DESIGN AND TECHNOLOGY

WORLD ASSOCIATION OF TECHNOLOGY TEACHERS https://www.facebook.com/groups/254963448192823/ www.technologystudent.com © 2017 V.Ryan © 2017

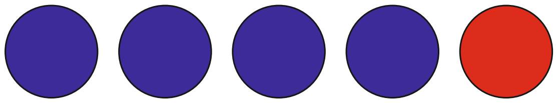
RATIOS - EXAMPLES

DEFINITION:

A ratio is the mathematical relationship between two or more numbers.

An example of a ratio is:

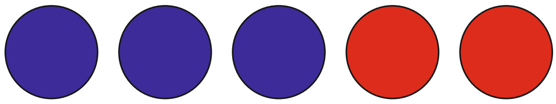
4:1



Here we see 4 blue circles compared to 1 red circle.

An example of a ratio is:

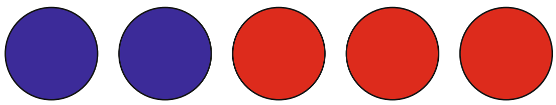
3:2



Here we see 3 blue circles compared to 2 red circles.

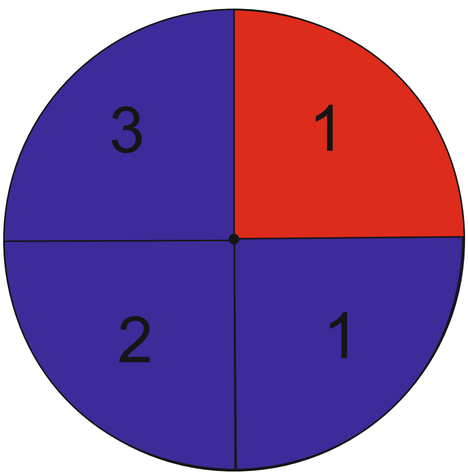
An example of a ratio is:

2:3



Here we see 2 blue circles compared to 3 red circles.

The circle below shows the area of blue in ratio with the area of red. There are 3 areas of red to just 1 area of blue.



BLUE : RED

3:1

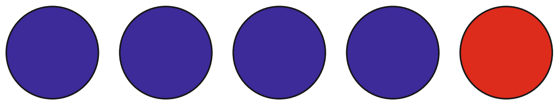
RATIOS - QUESTIONS

DEFINITION:

A ratio is the mathematical relationship between two or more numbers.

1. What is the ratio of blue to red dots?:

___ : ___



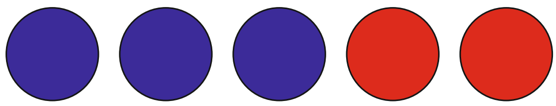
EXPLANATION: ______________________________

____

____

2. What is the ratio of blue to red dots?:

___ : ___



EXPLANATION: ______________________________

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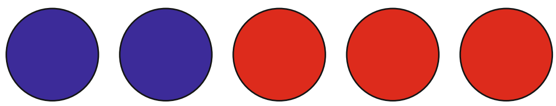
____

2. What is the ratio of blue to red dots?:

___ : ___



EXPLANATION: ______________________________

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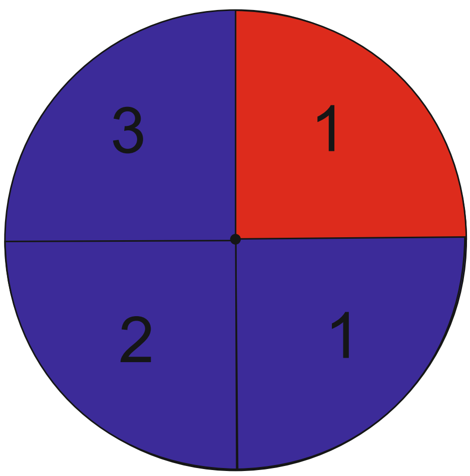
____

The circle below shows the area of blue in ratio with the area of red. What is the ratio of blue to red?

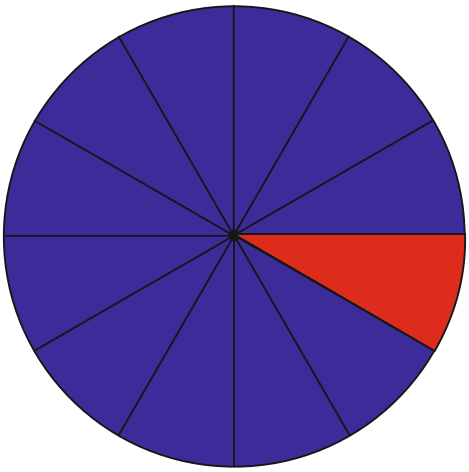


BLUE : RED

___ : ___

RATIOS - EXAMPLES

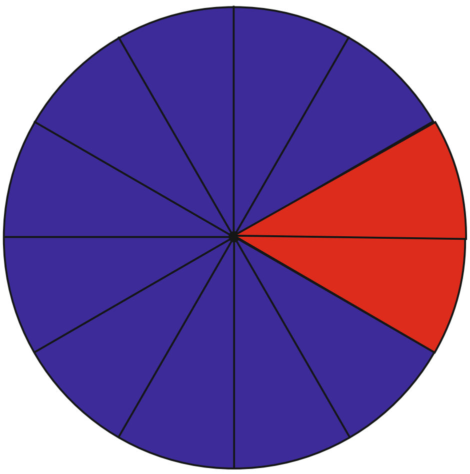
What is the ratio of the blue area to the red area?



BLUE : RED

11:1

The circle below is divided into blue and red areas. The ratio of the blue to the red is 10:2, because there are 10 blue sections compared to the 2 red sections. This is the same as 5:1



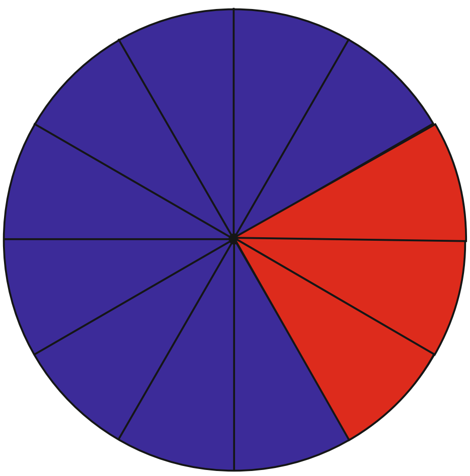
BLUE : RED

10:2

Which is the same as,

5:1

The circle below is divided into blue and red areas. The ratio of the blue to the red is 9:3, because there are 10 blue sections compared to the 2 red sections. This is the same as 5:1



BLUE : RED

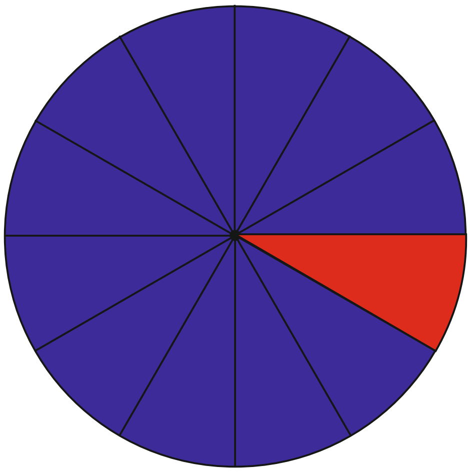
9:3

Which is the same as,

3:1

RATIOS - QUESTIONS

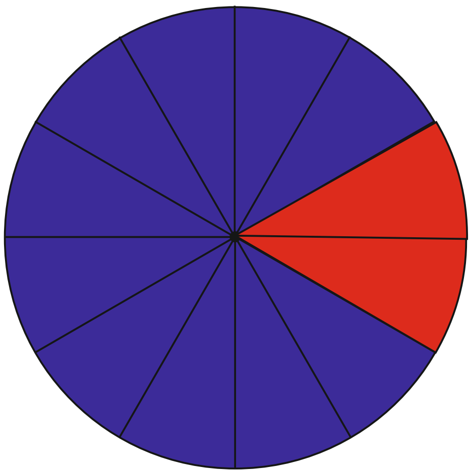
What is the ratio of the blue area to the red area?



BLUE : RED

___:___

The circle below is divided into blue and red areas. What is the ratio of blue to red sections?



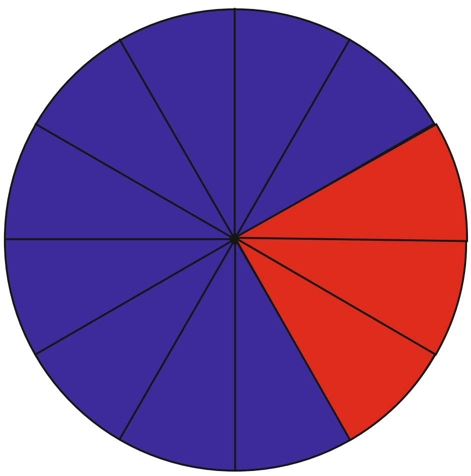
BLUE : RED

___:___

Which is the same as,

___:___

The circle below is divided into blue and red areas. What is the ratio of blue to red sections?



BLUE : RED

___:___

Which is the same as,

___:___

RATIOS - EXAMPLES

Part of a recipe to serve two people, requires 4 cups of flour and 1 cup of water.

If the has to be scaled up to serve 10 people, how many cups of flour and water will be required as part of the recipe.

	FLOUR		WATER
SERVES TWO PEOPLE =	4	:	1

To find the number by which the original ratio numbers are multiplied, divide the new number of people to be served (10) by the old number of people to be served (2).

$$\frac{10 \text{ PEOPLE}}{2 \text{ PEOPLE}} = 5$$

Then, multiply each number of the original ratio by the answer 5, to find the new amount of flour and water.

4x5 : 1x5

The new number of cups of flour and water are seen opposite

FLOUR		WATER
20	:	5

If the has to be scaled up to serve 12 people, how many cups of flour and water will be required as part of the recipe.

	FLOUR		WATER
SERVES TWO PEOPLE =	4	:	1

To find the number by which the original ratio numbers are multiplied, divide the new number of people to be served (12) by the old number of people to be served (2).

$$\frac{12 \text{ PEOPLE}}{2 \text{ PEOPLE}} = 6$$

Then, multiply each number of the original ratio by the answer 6, to find the new amount of flour and water.

4x6 : 1x6

The new number of cups of flour and water are seen opposite

FLOUR		WATER
24	:	6

RATIOS - QUESTIONS

Part of a recipe to serve two people, requires 4 cups of flour and 1 cup of water.

FLOUR | WATER

If the has to be scaled up to serve 10 people, how many cups of flour and water will be required as part of the recipe.

	FLOUR		WATER
SERVES TWO PEOPLE =	4	:	1

EXPLANATION: ______________________________

____

____

____

____

____

If the has to be scaled up to serve 12 people, how many cups of flour and water will be required as part of the recipe.

	FLOUR		WATER
SERVES TWO PEOPLE =	4	:	1

EXPLANATION: ______________________________

____

____

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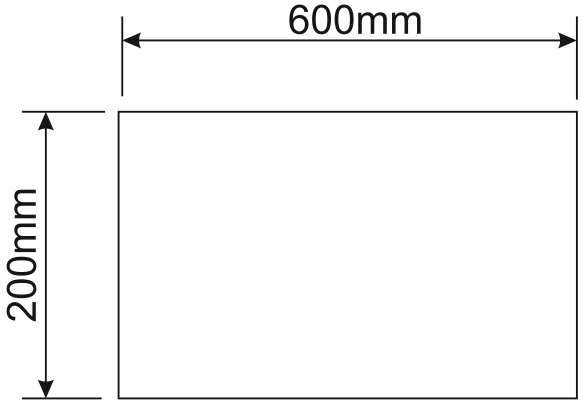
____

____

USING RATIOS TO SCALE DRAWINGS - EXAMPLES

The rectangle seen opposite has a height of 200mm and a length of 600



The ratio of the HEIGHT to the LENGTH is worked out by dividing the large number by the smaller number.

HEIGHT : LENGTH

$$\frac{600}{200} = 3$$

This means that the ratio is:

1:3

If the height is to be increased to 400mm and the ratio between the height and length is the same, what is the new measurement of the length?

1:3

400mm : ?

Quite simply multiply the 400mm by 3 to find the new measurement of the length

$$400 \times 3 = 1200$$

400mm : 1200mm

If the height is to be increased to 600mm and the ratio between the height and length is the same, what is the new measurement of the length?

1:3

600mm : ?

Quite simply multiply the 600mm by 3 to find the new measurement of the length

$$600 \times 3 = 1800$$

600mm : 1800mm

USING RATIOS TO SCALE DRAWINGS - EXAMPLES

If the height is to be increased to 500mm and the ratio between the height and length is the same, what is the new measurement of the length?

1:3

500mm : ?

Quite simply multiply the 400mm by 3 to find the new measurement of the length

500 x 3 = 1500

500mm : 1500mm

If the height is to be decreased to 100mm and the ratio between the height and length is the same, what is the new measurement of the length?

1:3

100mm : ?

Quite simply multiply the 400mm by 3 to find the new measurement of the length

100 x 3 = 300

100mm : 300mm

If the height is to be decreased to 800mm and the ratio between the height and length is the same, what is the new measurement of the length?

1:3

800mm : ?

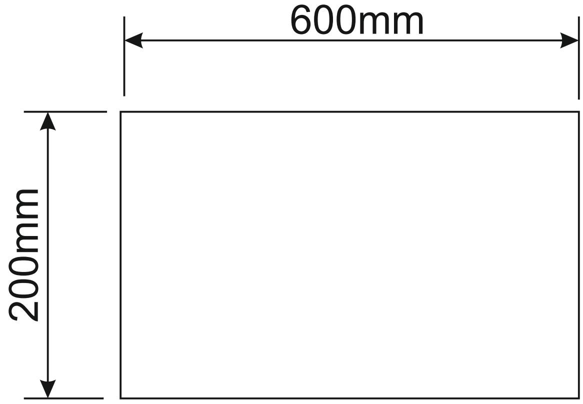
Quite simply multiply the 400mm by 3 to find the new measurement of the length

800 x 3 = 2400

800mm : 2400mm

USING RATIOS TO SCALE DRAWINGS - QUESTIONS

The rectangle seen opposite has a height of 200mm and a length of 600



The ratio of the HEIGHT to the LENGTH is worked out by dividing the large number by the smaller number.

HEIGHT : LENGTH

$$\frac{600}{200} = 3$$

This means that the ratio is:

1:3

If the height is to be increased to 400mm and the ratio between the height and length is the same, what is the new measurement of the length?

1:3

400mm : ?

EXPLANATION: ____________________

____

CALCULATION:

If the height is to be increased to 600mm and the ratio between the height and length is the same, what is the new measurement of the length?

1:3

600mm : ?

EXPLANATION: ____________________

____

CALCULATION:

USING RATIOS TO SCALE DRAWINGS - QUESTIONS

If the height is to be increased to 500mm and the ratio between the height and length is the same, what is the new measurement of the length?

1:3

500mm : ?

EXPLANATION:

CALCULATION:

If the height is to be decreased to 100mm and the ratio between the height and length is the same, what is the new measurement of the length?

1:3

100mm : ?

EXPLANATION:

CALCULATION:

If the height is to be decreased to 800mm and the ratio between the height and length is the same, what is the new measurement of the length?

1:3

800mm : ?

EXPLANATION:

CALCULATION:

FURTHER EXAMPLE QUESTIONS

PART ONE

The question is about alternative energy. A local wind farm produces 4 terawatt hours of electricity over a year. At the same time, a solar farm produced 0.5 terawatt hours of electrical power. What is the ratio Wind farm : Solar Power ?

WIND FARM	:	SOLAR POWER
4	:	0.5

To ensure that final ratio is in whole numbers, divide the wind power total by the solar power total.

$$\frac{\text{WIND FARM}}{\text{SOLAR POWER}} = \frac{4}{0.5} = 8$$

Then take the answer and place it on the wind power side of the ratio and the 1 on the solar power side.

WIND FARM	:	SOLAR POWER
8	:	1

PART TWO

The total alternative energy produced by the wind farm is 4 terawatt hours. The ratio between wind power and all other forms of alternative energy produced in the area is 1:6. What is the total amount of energy produced by the other alternative energy forms?

WIND FARM	:	ALL OTHER FORMS OF ALTERNATIVE ENERGY
1	:	6
4 terawatt hours	:	?

To calculate the answer, take the 4 terawatts and multiply by 6.

4 terawatts x 6 = 24 terawatt hours produced by all other forms of alternative energy

FURTHER EXAMPLE QUESTIONS

The total amount of renewable energy produced in 2016 was 90 Terawatt hours (Twh).

The ratio of hydroelectricity compared to other renewable energy forms was 1:12.

What amount of energy was produced through hydroelectricity ?

HYDROELECTRICITY : OTHER RENEWABLE FORMS

1 : 12

Add both numbers (1 and 12) together. This gives us 13

Then, divide the total amount of renewable energy (90 terawatt hours) by 13

$$\frac{90}{13} = 6.92 \text{ terawatt hours}$$

If total amount of renewable energy produced in 2016 was 100 Terawatt hours (Twh) AND the ratio of hydroelectricity compared to other renewable energy forms was 1:9.

What amount of energy was produced through hydroelectricity ?

HYDROELECTRICITY : OTHER RENEWABLE FORMS

1 : 9

Add both numbers (1 and) together. This gives us 10

Then, divide the total amount of renewable energy (100 terawatt hours) by 10.

$$\frac{100}{10} = 10 \text{ terawatt hours}$$

FURTHER QUESTIONS

PART ONE

The question is about alternative energy. A local wind farm produces 4 terawatt hours of electricity over a year. At the same time, a solar farm produced 0.5 terawatt hours of electrical power. What is the ratio Wind farm : Solar Power ?

WIND FARM	:	SOLAR POWER
4	:	0.5

EXPLANATION: ______________________

____

____

____

____

____

PART TWO

The total alternative energy produced by the wind farm is 4 terawatt hours. The ratio between wind power and all other forms of alternative energy produced in the area is 1:6. What is the total amount of energy produced by the other alternative energy forms?

WIND FARM	:	ALL OTHER FORMS OF ALTERNATIVE ENERGY
1	:	6

EXPLANATION: ______________________

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FURTHER QUESTIONS

The total amount of renewable energy produced in 2016 was 90 Terawatt hours (Twh).

The ratio of hydroelectricity compared to other renewable energy forms was 1:12.

What amount of energy was produced through hydroelectricity ?

HYDROELECTRICITY : OTHER RENEWABLE FORMS

1 : 12

EXPLANATION: ______________________

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If total amount of renewable energy produced in 2016 was 100 Terawatt hours (Twh) AND the ratio of hydroelectricity compared to other renewable energy forms was 1:9.

What amount of energy was produced through hydroelectricity ?

HYDROELECTRICITY : OTHER RENEWABLE FORMS

1 : 9

EXPLANATION: ______________________

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MATHEMATICAL SKILLS

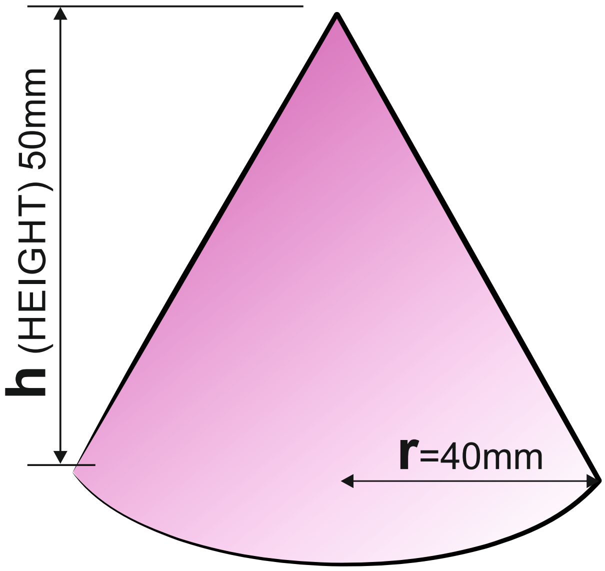
VOLUME OF A CONE

DESIGN AND TECHNOLOGY

WORLD ASSOCIATION OF TECHNOLOGY TEACHERS https://www.facebook.com/groups/254963448192823/ www.technologystudent.com © 2017 V.Ryan © 2017

HOW TO CALCULATE THE VOLUME OF A CONE

DEFINITION: A cone has one surface with a circular base. The vertex is directly above the centre of the circular base.



FORMULA

$$v=1/3\ \pi r^2 h$$

the same as $v=\dfrac{\pi r^2 h}{3}$

pi (π) is 3.14

If the height (h) is 50mm and the radius is 40mm

Then:

$$v=1/3\ \pi r^2 h$$

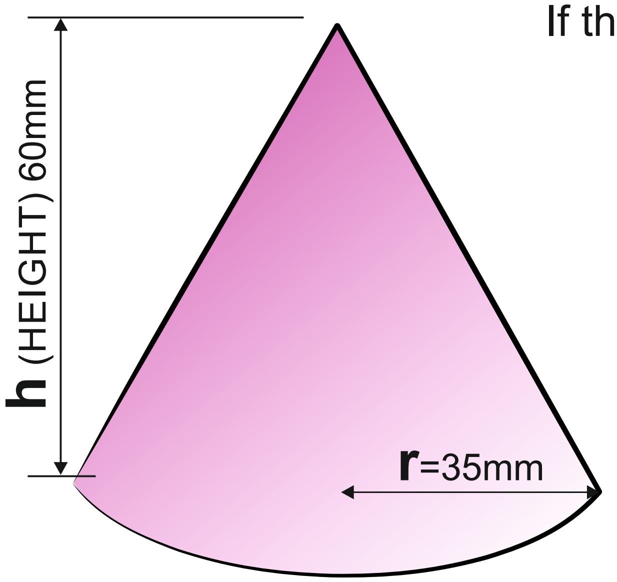
$$v=\frac{1}{3} \times 3.14 \times (40 \times 40) \times 50$$

$$v=\frac{1}{3} \times 251200$$

$$v=\frac{251200}{3} = 83733.33\text{mm}^3$$

EXAMINATION QUESTIONS - VOLUME OF A CONE

$v=1/3\ \pi r^2h$ **Using the formula opposite, calculate the volumes of the following cones. (pi (π) is 3.14)**



If the height (h) is 60mm and the radius is 35mm

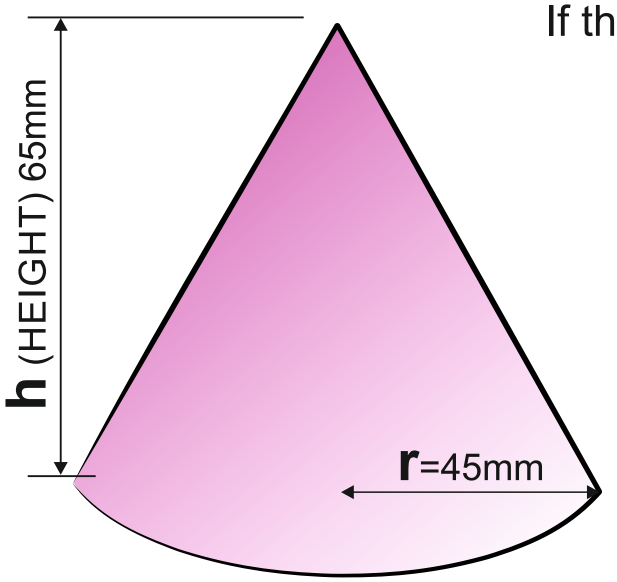
$$v=1/3\ \pi r^2h$$

$$v= \frac{1}{3} \times 3.14 \times (35 \times 35) \times 60$$

$$v= \frac{1}{3} \times 3.14 \times (1225) \times 60$$

$$v= \frac{1}{3} \times 230790$$

$$v= \frac{230790}{3} = 76930mm^3$$



If the height (h) is 65mm and the radius is 45mm

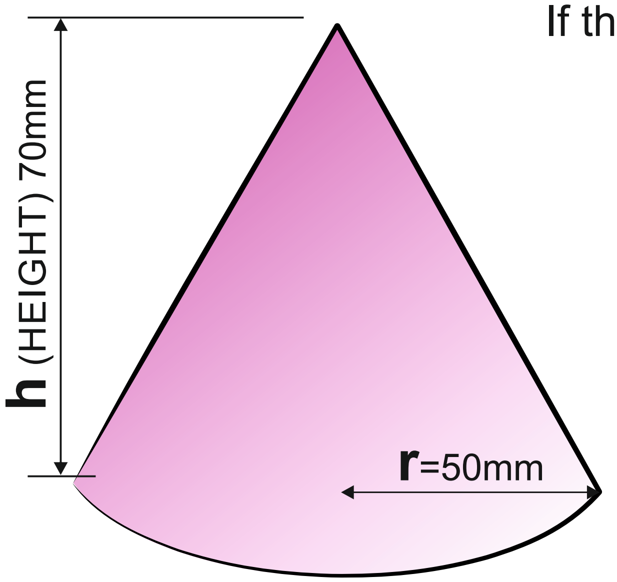
$$v=1/3\ \pi r^2h$$

$$v= \frac{1}{3} \times 3.14 \times (45 \times 45) \times 65$$

$$v= \frac{1}{3} \times 3.14 \times (2025) \times 65$$

$$v= \frac{1}{3} \times 413302.5$$

$$v= \frac{413302.5}{3} = 137767.5mm^3$$



If the height (h) is 70mm and the radius is 50mm

$$v=1/3\ \pi r^2h$$

$$v= \frac{1}{3} \times 3.14 \times (50 \times 50) \times 70$$

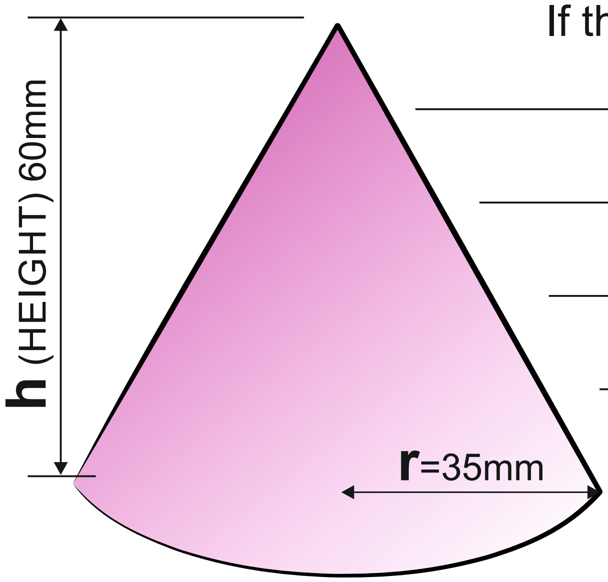
$$v= \frac{1}{3} \times 3.14 \times (2500) \times 70$$

$$v= \frac{1}{3} \times 549500$$

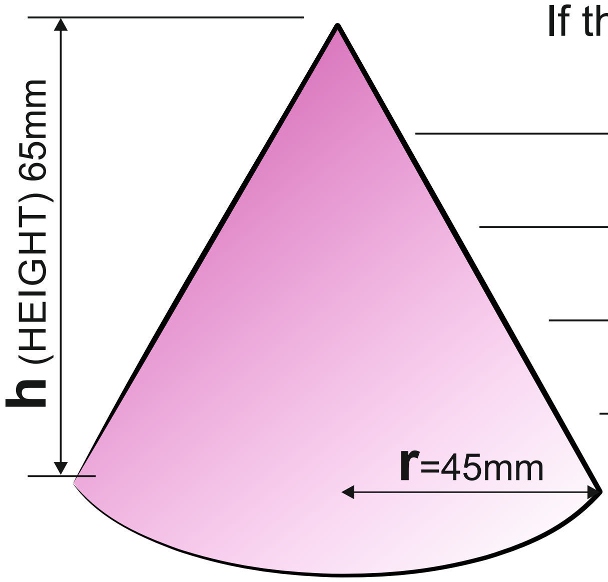
$$v= \frac{549500}{3} = 183166.66mm^3$$

EXAMINATION QUESTIONS - VOLUME OF A CONE

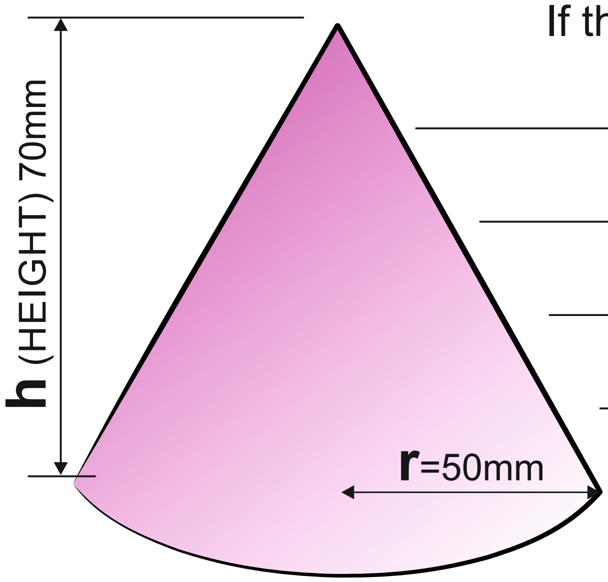
$v=1/3\ \pi r^2 h$ **Using the formula opposite, calculate the volumes of the following cones. (pi (π) is 3.14)**



If the height (h) is 60mm and the radius is 35mm



If the height (h) is 65mm and the radius is 45mm



If the height (h) is 70mm and the radius is 50mm

MATHEMATICAL SKILLS

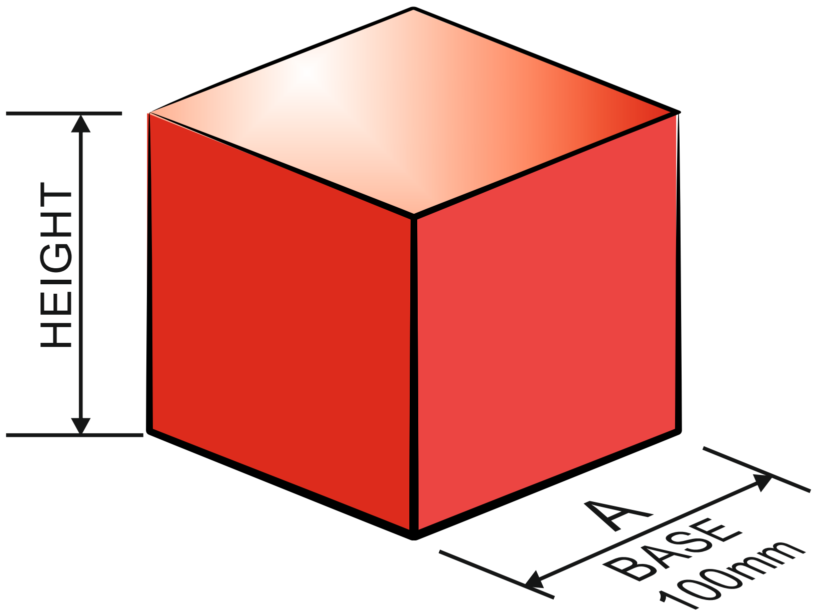
VOLUME OF A CUBE AND ASSOCIATED GEOMETRICAL SHAPES

DESIGN AND TECHNOLOGY

WORLD ASSOCIATION OF TECHNOLOGY TEACHERS https://www.facebook.com/groups/254963448192823/ www.technologystudent.com © 2017 V.Ryan © 2017

HOW TO CALCULATE THE VOLUME OF A CUBE

DEFINITION: A cube is a solid object, composed of six equal squares, with a 90 degree angle between adjacent sides.



All the sides of a cube are the same measurement. There are two similar formulas for calculating a cube's volume.

VOLUME (V) = $A \times A \times A$

OR A^3

EXAMPLE 1

If the measurement of one side is 100mm:

VOLUME = 100mm x 100mm x 100mm

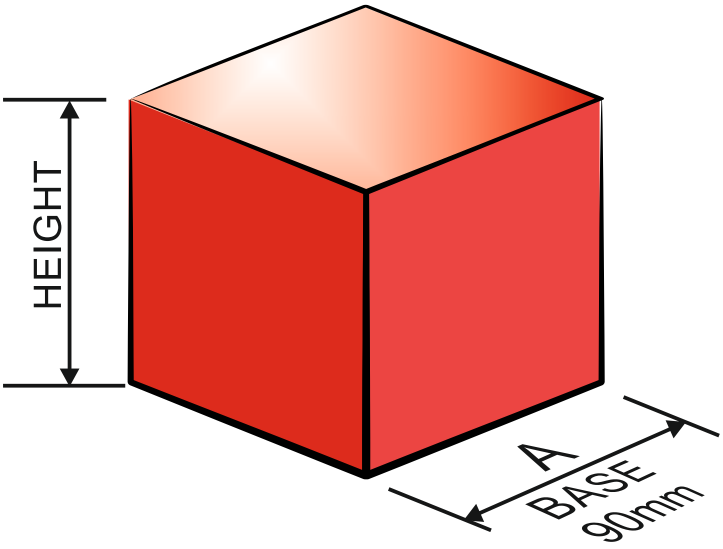
VOLUME = 1000000mm^3 or 1000cm^3

EXAMPLE 2

If the measurement of one side is 320mm:

VOLUME = 320mm x 320mm x 320mm

VOLUME = 32768000mm^3 or 32768cm^3



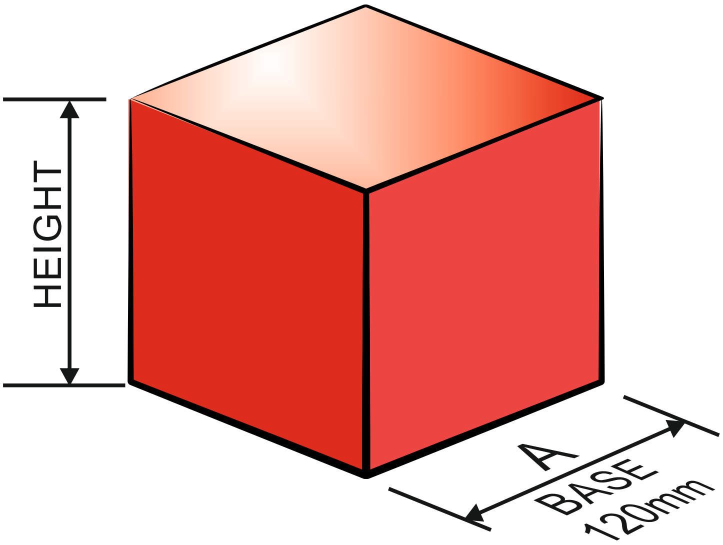
QUESTION 1

What is the volume of the cube
shown opposite?

VOLUME (V) = A x A x A
OR A^3

If the measurement of one side is 90mm:

VOLUME = 90mm x 90mm x 90mm
VOLUME = 729000mm³ or 729cm³



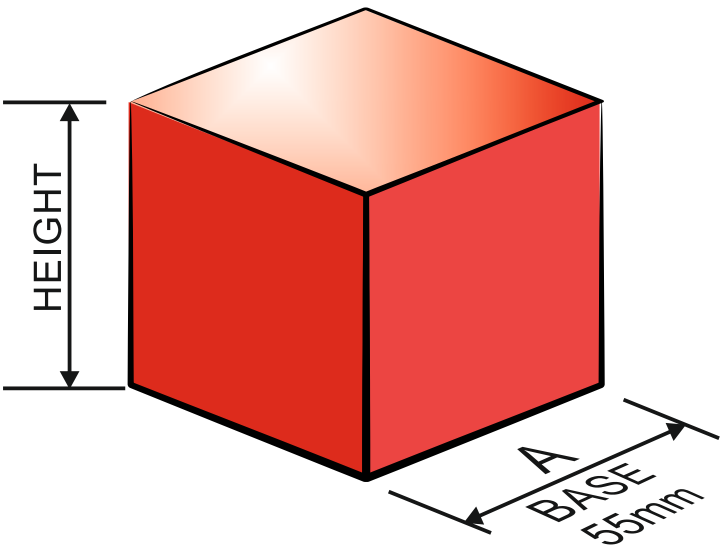
QUESTION 2

What is the volume of the cube
shown opposite?

VOLUME (V) = A x A x A
OR A^3

If the measurement of one side is 120mm:

VOLUME = 120mm x 120mm x 120mm
VOLUME = 1728000mm³ or 1728cm³



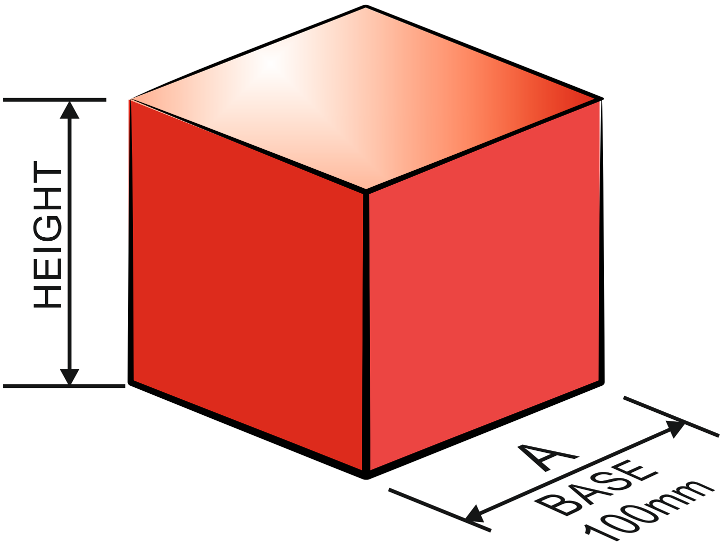
QUESTION 3

What is the volume of the cube
shown opposite?

VOLUME (V) = A x A x A
OR A^3

If the measurement of one side is 55mm:

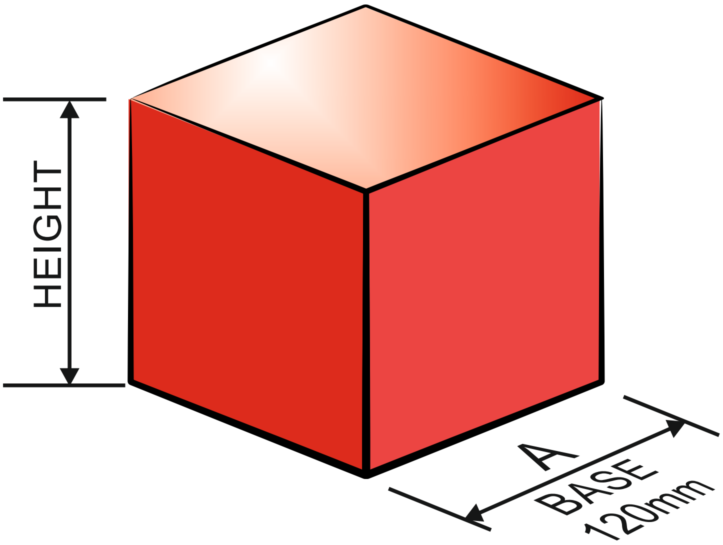
VOLUME = 55mm x 55mm x 55mm
VOLUME = 166375mm³ or 166.375cm³



QUESTION 1

What is the volume of the cube shown opposite?

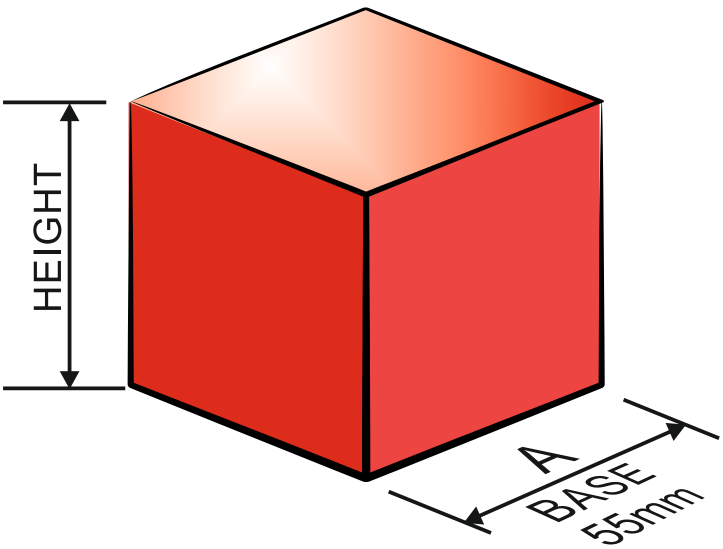
VOLUME (V) = A x A x A
OR A^3



QUESTION 2

What is the volume of the cube shown opposite?

VOLUME (V) = A x A x A
OR A^3

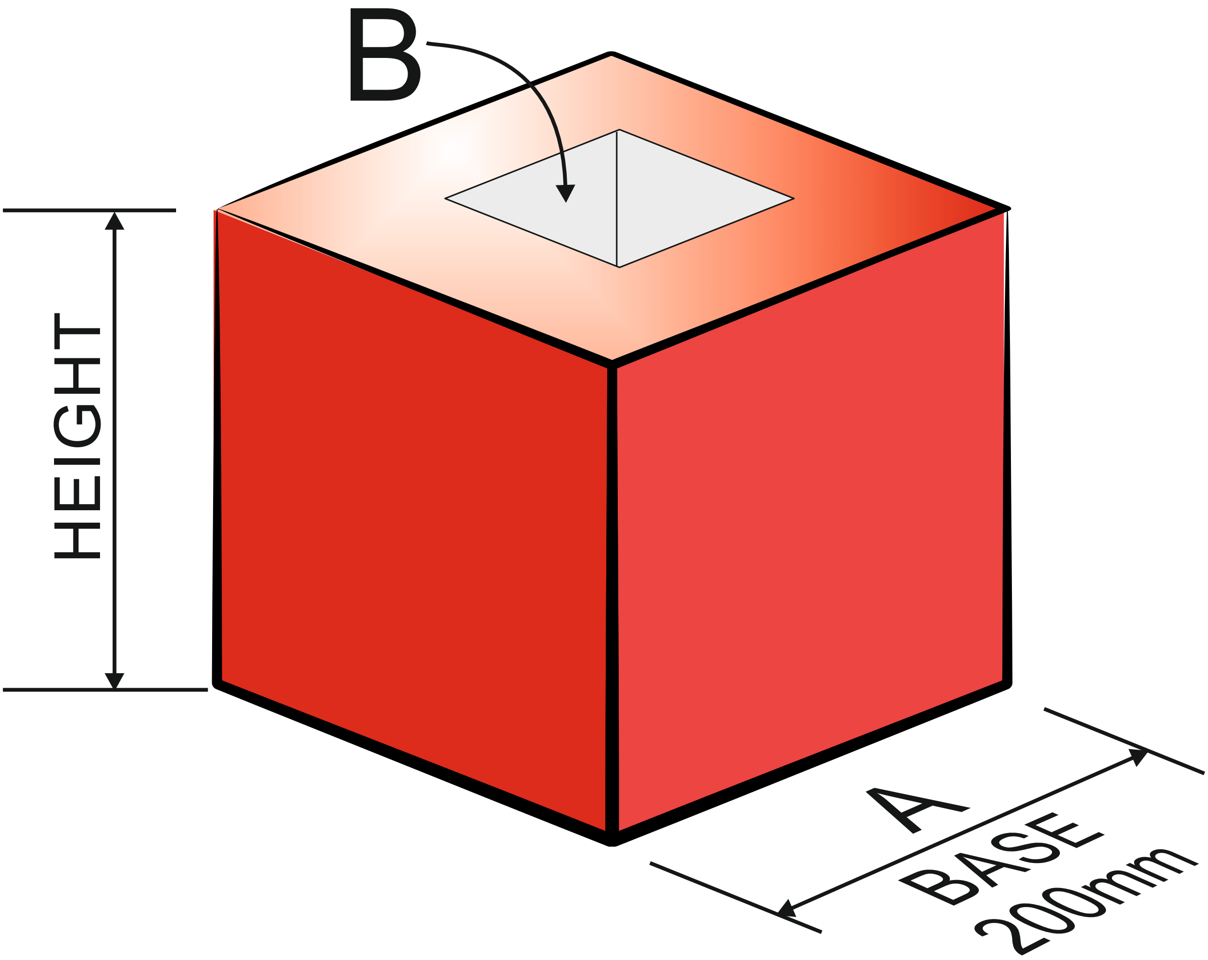


QUESTION 3

What is the volume of the cube shown opposite?

VOLUME (V) = A x A x A
OR A^3

EXAM QUESTION - CUBE



A solid cube of aluminium (A) has 200mm sides. However, a smaller area in the form of a cube with 100mm length sides, has been machined from the top surface (B).
What is the volume of the finished 3D shape?

How to work out the answer:

Start by treating both A and B as solid cubes.
Work out the volume of each cube A and B

CUBE 'A'

If the measurement of one side is 200mm:

VOLUME = 200mm x 200mm x 200mm
VOLUME = 8000000mm^3 or 8000cm^3

CUBE 'B'

If the measurement of one side is 100mm:

VOLUME = 100mm x 100mm x 100mm
VOLUME = 1000000mm^3 or 1000cm^3

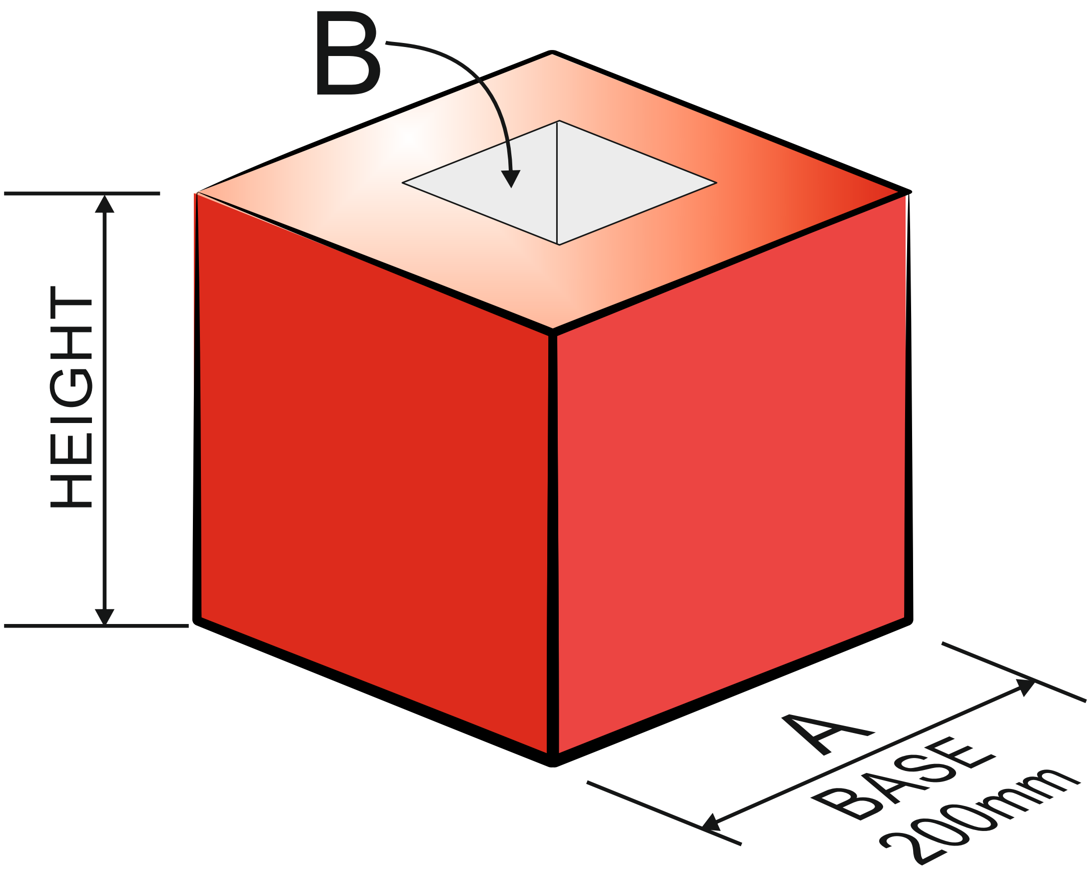
Then, subtract the volume of B away from the volume of A, to find the final overall volume

FINAL VOLUME = A - B

FINAL VOLUME = 8000000mm^3 - 1000000mm^3

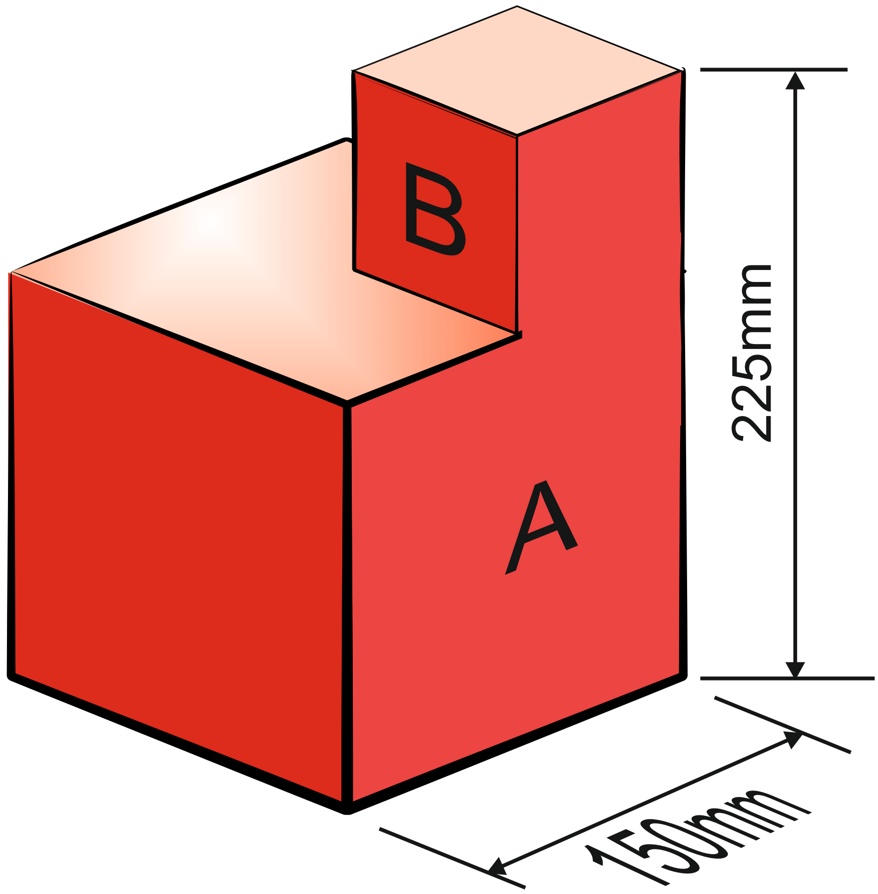
FINAL VOLUME = 7000000mm^3 or 7000cm^3

EXAM QUESTION - CUBE



A solid cube of aluminium (A) has 200mm sides. However, a smaller area in the form of a cube with 100mm length sides, has been machined from the top surface (B).
What is the volume of the finished 3D shape? Explain your working out.

EXAM QUESTION - CUBE



The unusual solid geometrical shape shown opposite can be treated as two cubes.

Calculate the entire volume of the shape/form.

Explain your working out.

The measurement of a side of cube A is clearly shown as 150mm

To work out the length of one side of cube B, simply subtract 150mm from the overall height of the shape.

225mm (overall height) - 150mm (length of one side of cube A)

225mm - 150mm = 75mm (this is the length of one side of cube B)

Then work out the volume of cubes A and B

CUBE 'A'

If the measurement of one side is 150mm:

VOLUME = 150mm x 150mm x 150mm
VOLUME = 3375000mm^3 or 3375cm^3

CUBE 'B'

If the measurement of one side is 75mm:

VOLUME = 75mm x 75mm x 75mm
VOLUME = 421875mm^3 or 421.875cm^3

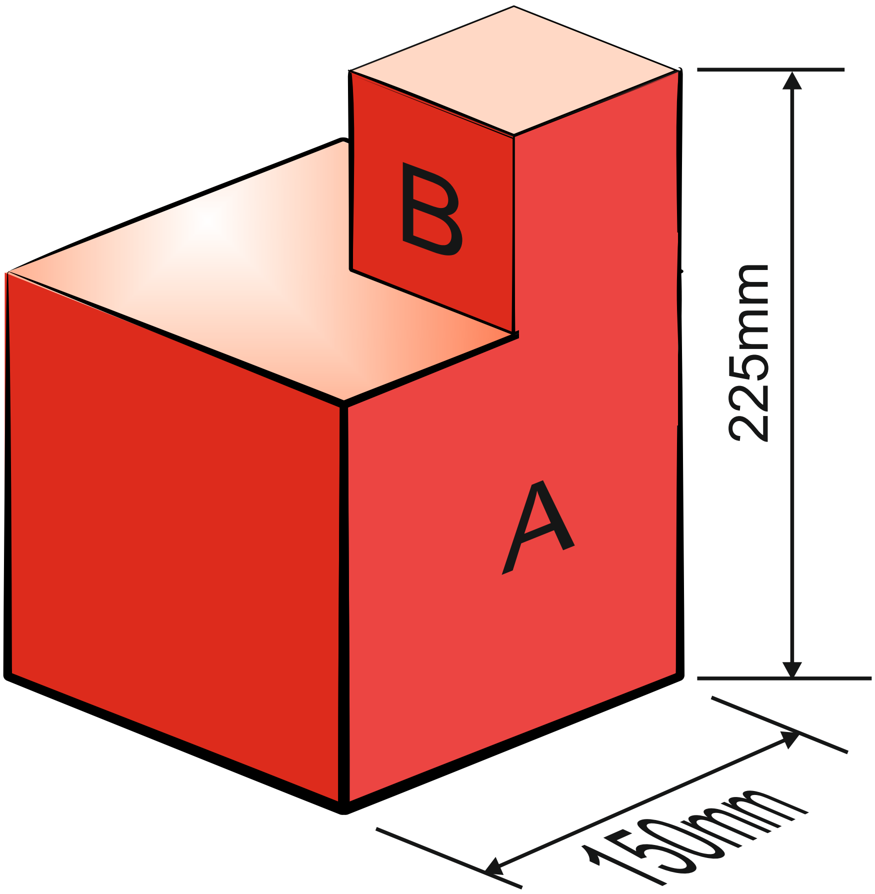
Then, add the volume of cube B with the volume of cube A, to find the final overall volume

FINAL VOLUME = A + B

FINAL VOLUME = 3375000mm^3 + 421875mm^3

FINAL VOLUME = 3796875mm^3 or 3796.875cm^3

EXAM QUESTION - CUBE



The unusual solid geometrical shape shown opposite can be treated as two cubes.

Calculate the entire volume of the shape/form.

Explain your working out.

MATHEMATICAL SKILLS

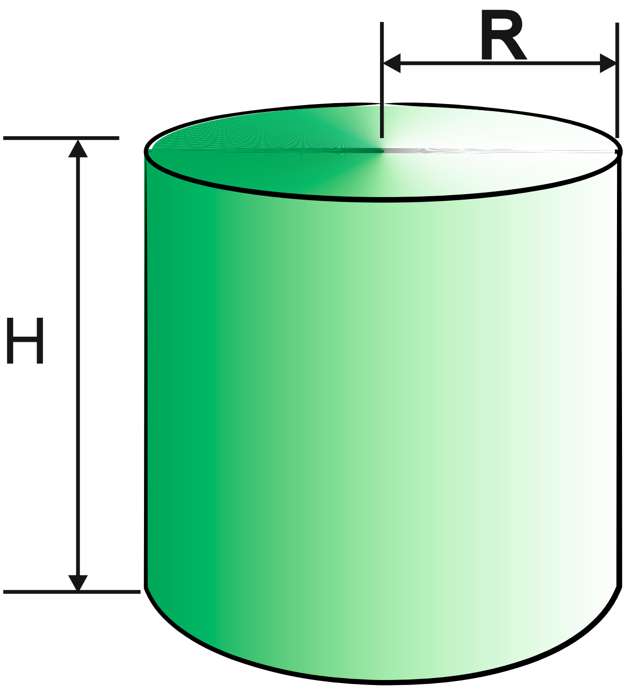
VOLUME OF A CYLINDER AND ASSOCIATED GEOMETRICAL SHAPES

DESIGN AND TECHNOLOGY

WORLD ASSOCIATION OF TECHNOLOGY TEACHERS https://www.facebook.com/groups/254963448192823/ www.technologystudent.com © 2017 V.Ryan © 2017

HOW TO CALCULATE THE VOLUME OF A CYLINDER

DEFINITION: A three dimensional geometrical shape, that has a circle at each end of a single curved surface.

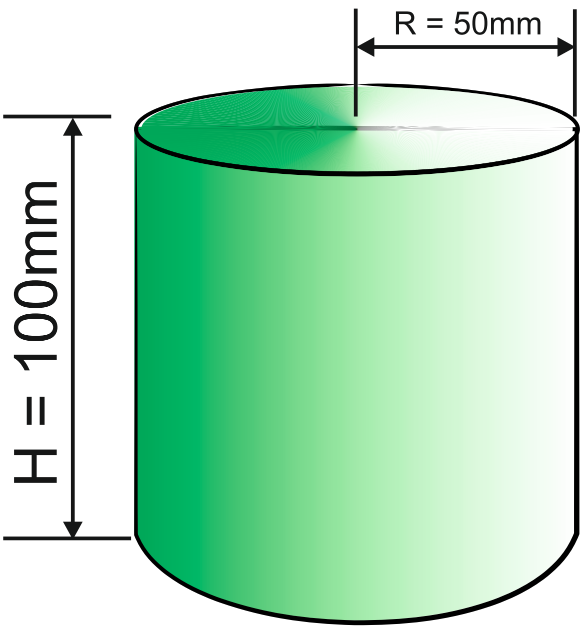


In order to calculate the volume of a cylinder, the height and radius of the circular top /bottom must be known. The following formula is used to calculate the volume.

$$v = \pi r^2 h$$

volume = pi x radius² x height

$$\pi \text{ (pi)} = 3.14$$



$$v = \pi r^2 h$$

volume = 3.14 x 50mm x 50mm x 100mm

volume = 785000mm³

or

volume = 785cm³

Calculate the volume of the cylinders seen below.

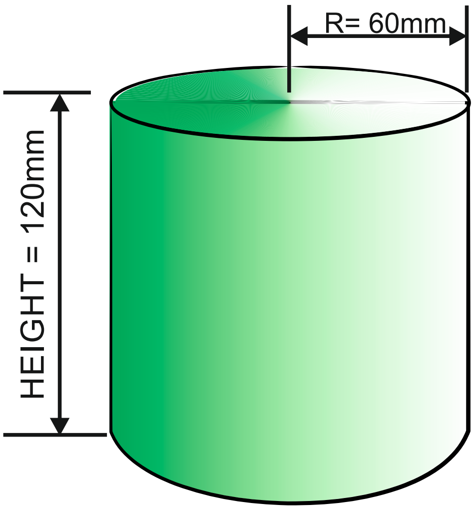
For the purpose of these calculations
π (pi) = 3.14

FORMULA

$v = \pi r^2 h$

volume = pi x radius² x height

π (pi) = 3.14



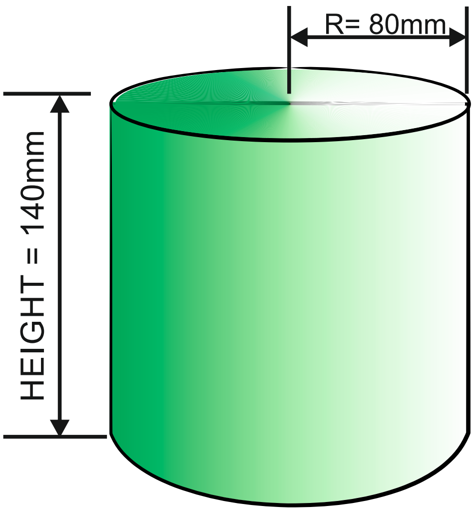
$v = \pi r^2 h$

volume = 3.14 x 60mm x 60mm x 120mm

volume = 1356480mm³

or

volume = 1356.480cm³



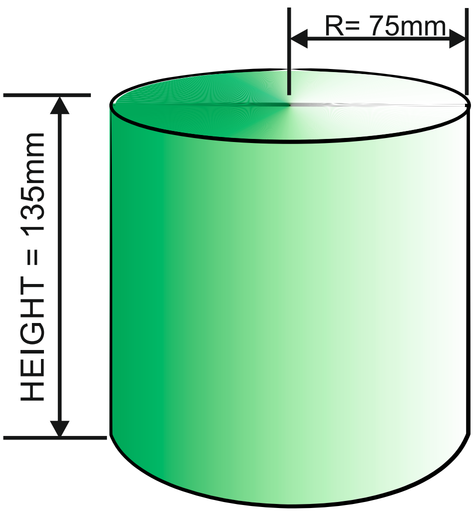
$v = \pi r^2 h$

volume = 3.14 x 80mm x 80mm x 140mm

volume = 2813440mm³

or

volume = 2813.440cm³



$v = \pi r^2 h$

volume = 3.14 x 75mm x 75mm x 135mm

volume = 2384437.5mm³

or

volume = 2384.437cm³

Calculate the volume of the cylinders seen below.

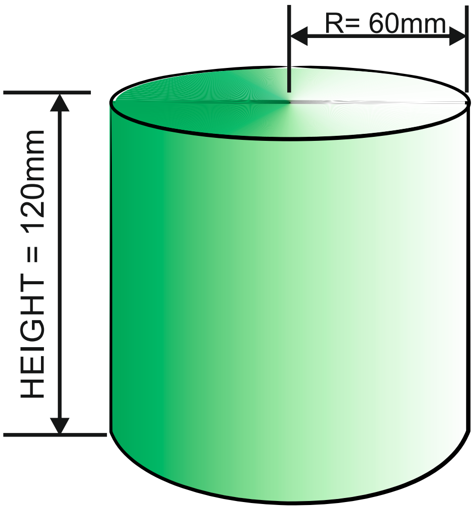
For the purpose of these calculations
π (pi) = 3.14

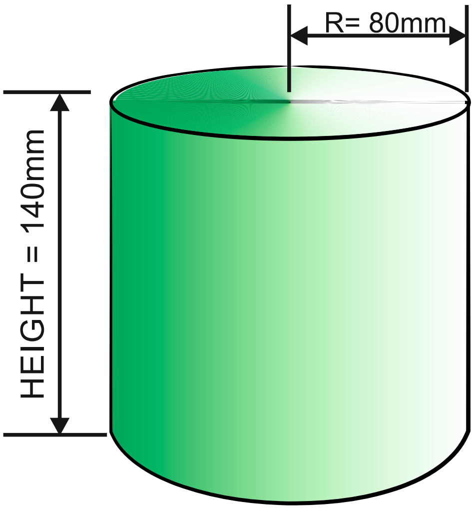
FORMULA

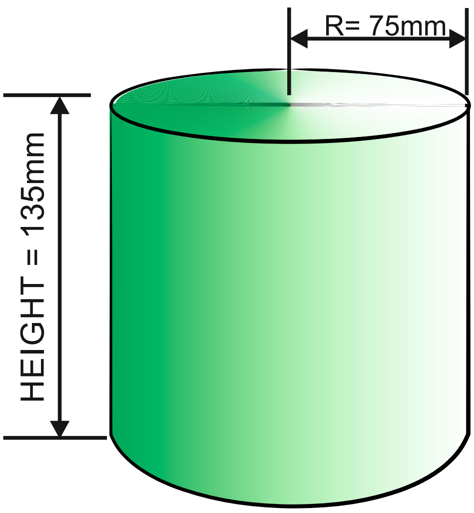
$v = \pi r^2 h$

volume = pi x radius² x height

π (pi) = 3.14

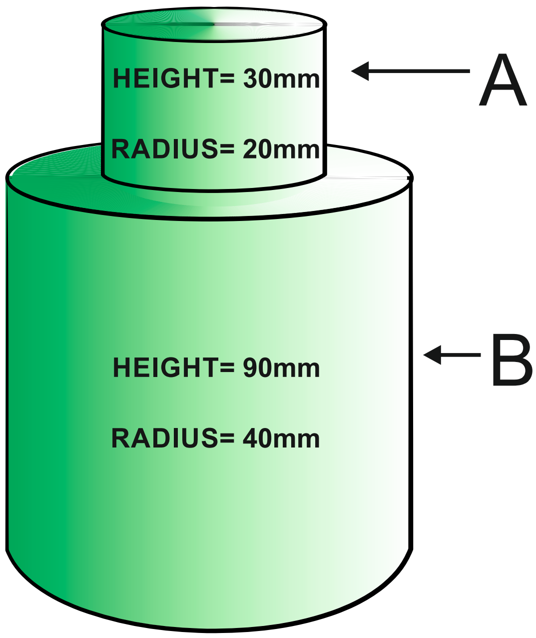






EXAMINATION QUESTION - CYLINDER - VOLUME

The solid steel object seen below, has been manufactured on an engineering centre lathe. It is one solid piece. Calculate the total volume.



In order to calculate the entire volume of the engineered solid, it is treated as two separate parts. Part A is the smaller cylinder and part B is the larger cylinder.

PART A

$v = \pi r^2 h$

volume = 3.14 x 20mm x 20mm x 30mm

volume = 37680mm³

or

volume = 37.680cm³

PART B

$v = \pi r^2 h$

volume = 3.14 x 40mm x 40mm x 90mm

volume = 452160mm³

or

volume = 452.160cm³

Then add both volumes together, to find the overall volume of the engineered object.

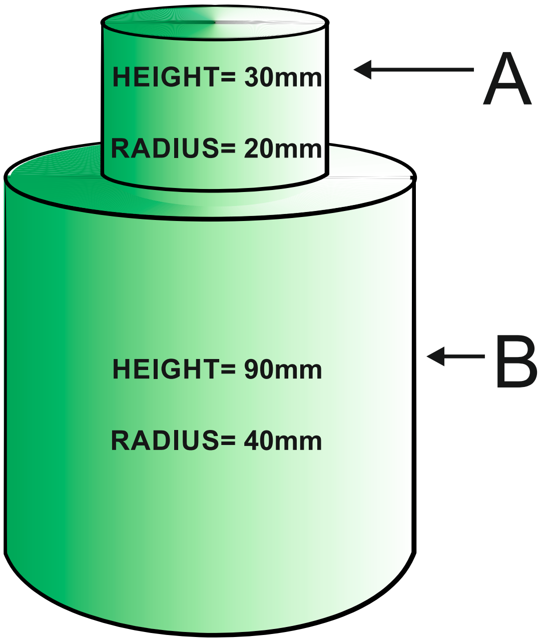
FINAL VOLUME = A + B

FINAL VOLUME = 37680mm³ + 452160mm³

FINAL VOLUME = 489840mm³ or 489.84cm³

EXAMINATION QUESTION - CYLINDER - VOLUME

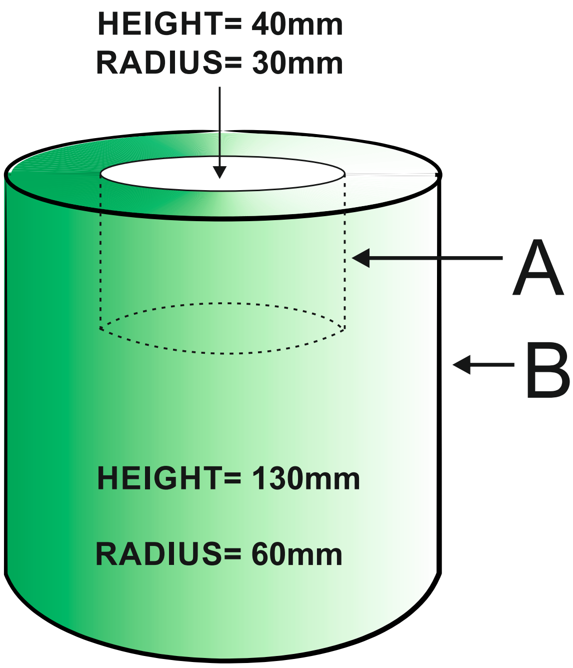
The solid steel object seen below, has been manufactured on an engineering centre lathe. It is one solid piece. Calculate the total volume.



In order to calculate the entire volume of the engineered solid, it is treated as two separate parts. Part A is the smaller cylinder and part B is the larger cylinder.

The solid cylindrical object seen below, is engineered from mild steel, with a large machined 'blind' hole, in the top surface.

Calculate the volume of the engineered object.



The cylindrical object is treated as two separate cylinders.

Part A is the 'blind' hole.
Part B is the cylinder.

PART A

$v = \pi r^2 h$

volume = 3.14 x 30mm x 30mm x 40mm

volume = 113040mm^3

or

volume = 113.040cm^3

PART B

$v = \pi r^2 h$

volume = 3.14 x 60mm x 60mm x 130mm

volume = 1469520mm^3

or

volume = 1469.520cm^3

Then subtract the volume of part A from the volume of part B, to find the overall volume of the engineered object.

FINAL VOLUME = B - A

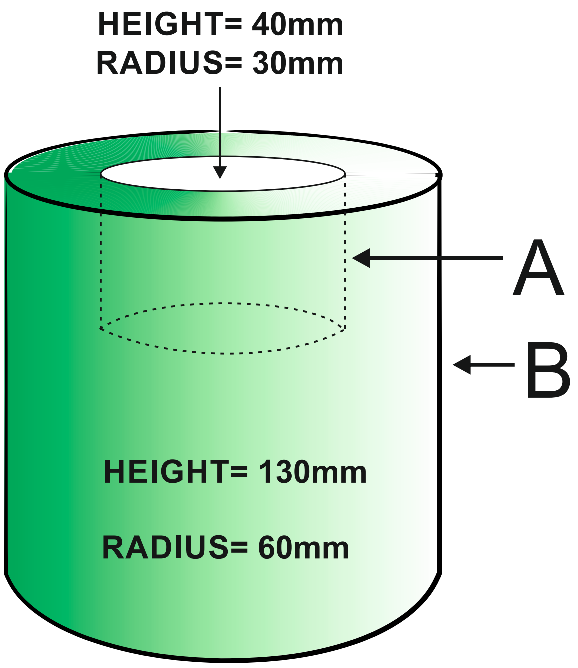
FINAL VOLUME = 1469520mm^3 - 113040mm^3

FINAL VOLUME = 1356480mm^3 or 1356.48cm^3

EXAMINATION QUESTION - CYLINDER - VOLUME

The solid cylindrical object seen below, is engineered from mild steel, with a large machined 'blind' hole, in the top surface.

Calculate the volume of the engineered object.



The cylindrical object is treated as two separate cylinders.

Part A is the 'Blind' hole.
Part B is the cylinder.

MATHEMATICAL SKILLS

VOLUME OF A SQUARE PYRAMID
AND
ASSOCIATED GEOMETRICAL SHAPES

DESIGN AND TECHNOLOGY

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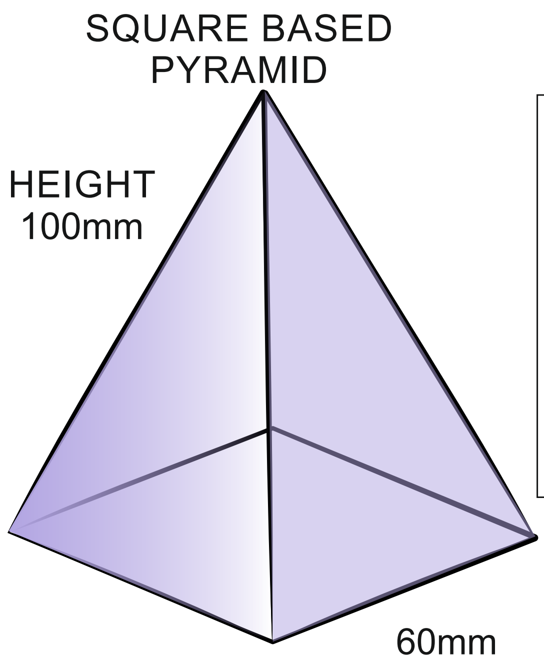
HOW TO CALCULATE THE VOLUME OF A REGULAR SQUARE PYRAMID

DEFINITION: A Regular Square Pyramid has a square base with triangular sides. The apex (highest point), is inline with the centre of the square base. A square pyramid is a relatively common geometrical shape/form.



FORMULA

$$\text{Volume} = \frac{1}{3} \times \text{Base} \times \text{Height}$$

$$V = \frac{1}{3} \times B \times H$$

CALCULATE THE AREA OF BASE FIRST

AREA OF BASE = LENGTH^2

AREA OF BASE = 60mm X 60mm = 3600mm^2

THEN APPLY THE FOLLOWING FORMULA

$$\text{Volume} = \frac{1}{3} \times \text{Base} \times \text{Height}$$

$$V = \frac{1}{3} \times 3600\text{mm} \times 100\text{mm}$$

$$V = \frac{1}{3} \times 360000\text{mm}$$

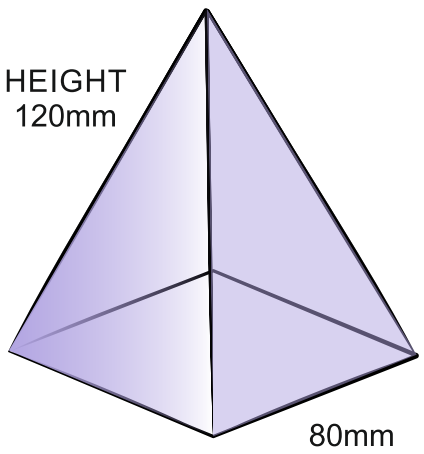
$$V = \frac{360000\text{mm}}{3} = 120000\text{mm}^3$$

FORMULA

$$\text{Volume} = \frac{1}{3} \times \text{Base} \times \text{Height}$$

$$V = \frac{1}{3} \times B \times H$$

Using the formula opposite, calculate the volumes of the following square pyramids.



CALCULATE THE AREA OF BASE FIRST

AREA OF BASE = LENGTH²

AREA OF BASE = 80mm X 80mm = 6400mm²

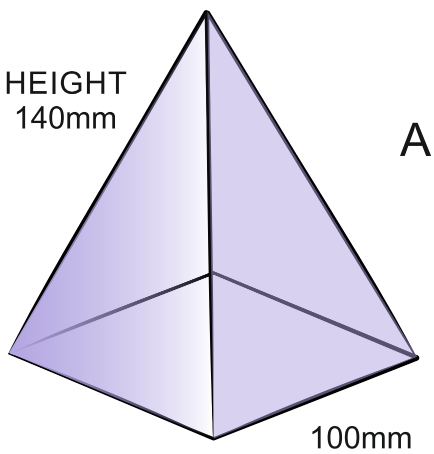
THEN APPLY THE FOLLOWING FORMULA

$$\text{Volume} = \frac{1}{3} \times \text{Base} \times \text{Height}$$

$$V = \frac{1}{3} \times 6400\text{mm} \times 120\text{mm}$$

$$V = \frac{1}{3} \times 768000\text{mm}$$

$$V = \frac{768000\text{mm}}{3} = 256000\text{mm}^3$$



CALCULATE THE AREA OF BASE FIRST

AREA OF BASE = LENGTH²

AREA OF BASE = 100mm X 100mm = 10000mm²

THEN APPLY THE FOLLOWING FORMULA

$$\text{Volume} = \frac{1}{3} \times \text{Base} \times \text{Height}$$

$$V = \frac{1}{3} \times 10000\text{mm} \times 140\text{mm}$$

$$V = \frac{1}{3} \times 1400000\text{mm}$$

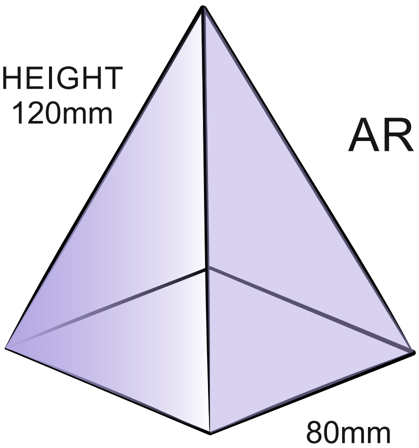
$$V = \frac{1400000\text{mm}}{3} = 466666.66\text{mm}^3$$

FORMULA

$$\text{Volume} = \frac{1}{3} \times \text{Base} \times \text{Height}$$

$$V = \frac{1}{3} \times B \times H$$

Using the formula opposite, calculate the volumes of the following square pyramids.



CALCULATE THE AREA OF BASE FIRST

AREA OF BASE = LENGTH²

AREA OF BASE = ______________________________

THEN APPLY THE FOLLOWING FORMULA

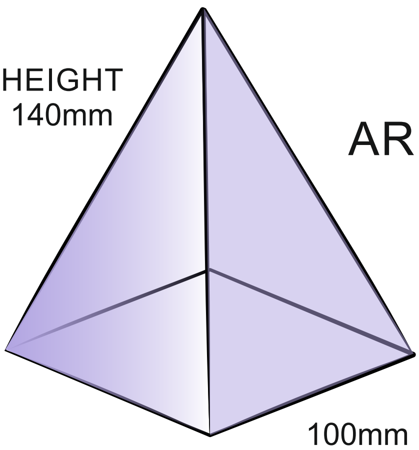
$$\text{Volume} = \frac{1}{3} \times \text{Base} \times \text{Height}$$

____

____

____

____



CALCULATE THE AREA OF BASE FIRST

AREA OF BASE = LENGTH²

AREA OF BASE = ______________________________

THEN APPLY THE FOLLOWING FORMULA

$$\text{Volume} = \frac{1}{3} \times \text{Base} \times \text{Height}$$

____

____

____

____

MATHEMATICAL SKILLS

VOLUME OF A RECTANGULAR PRISM
AND
ASSOCIATED GEOMETRICAL SHAPES

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DESIGN AND TECHNOLOGY

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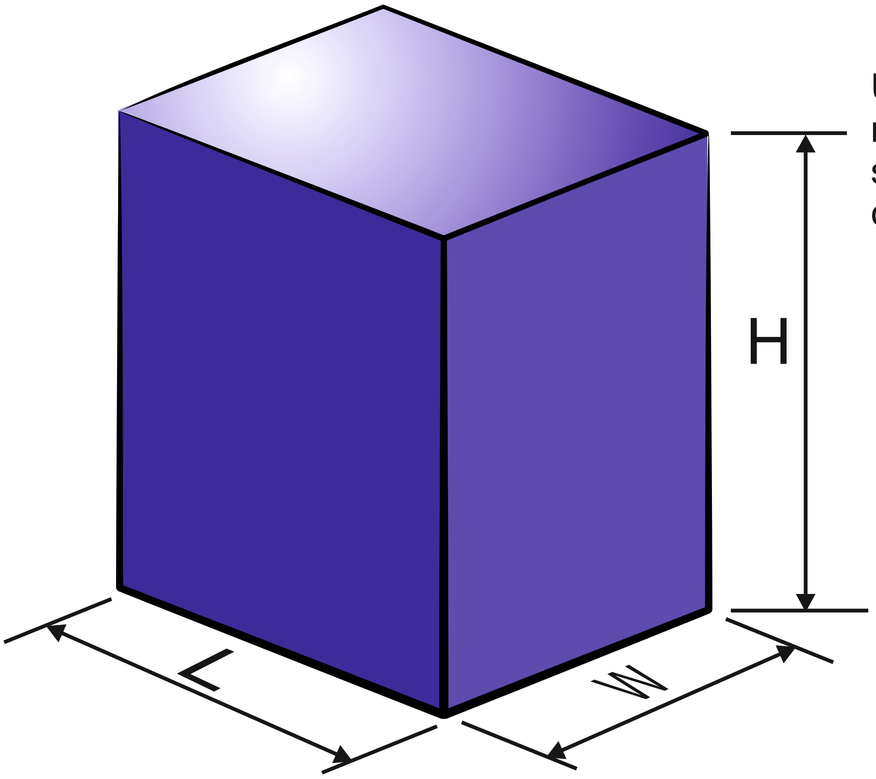
HOW TO CALCULATE THE VOLUME OF A RECTANGULAR PRISM

DEFINITION: A rectangular prism is a solid object, composed of six rectangles, with a 90 degree angle between adjacent sides. Opposite sides of a rectangular prism are equal and parallel to each other.



Unlike a cube, the area of the sides of a rectangular prism / cuboid are not the same, consequently the formula for calculating the volume is as follows:

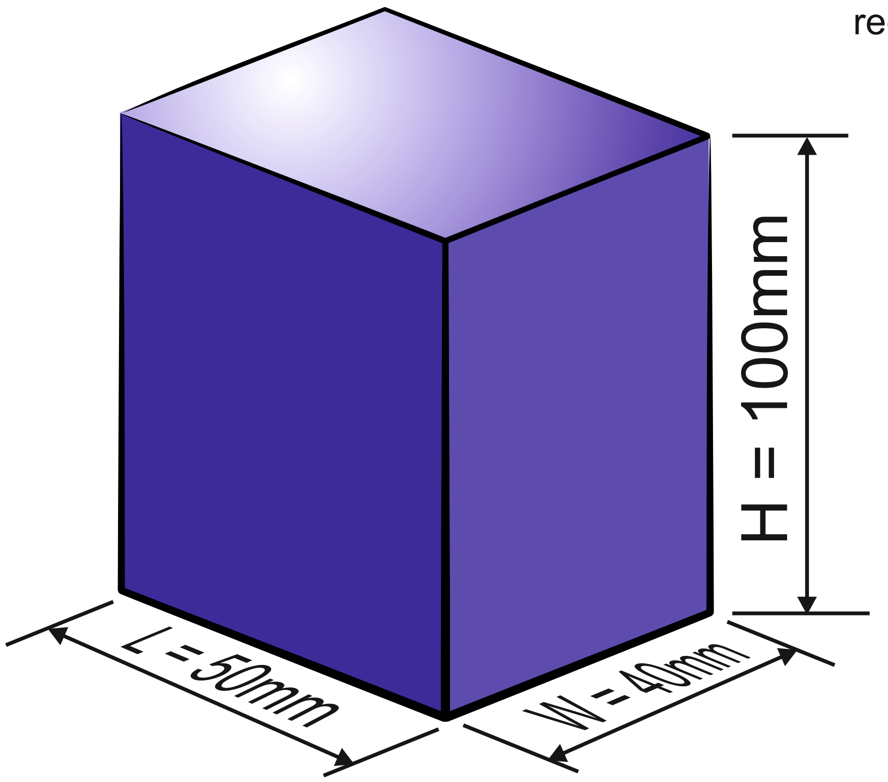
FORMULA

$$V = L \times W \times H$$

VOLUME = LENGTH X WIDTH X HEIGHT

$$V = L \times W \times H$$

EXAMPLE: What is the volume of the rectangular prism shown opposite?



$$V = L \times W \times H$$

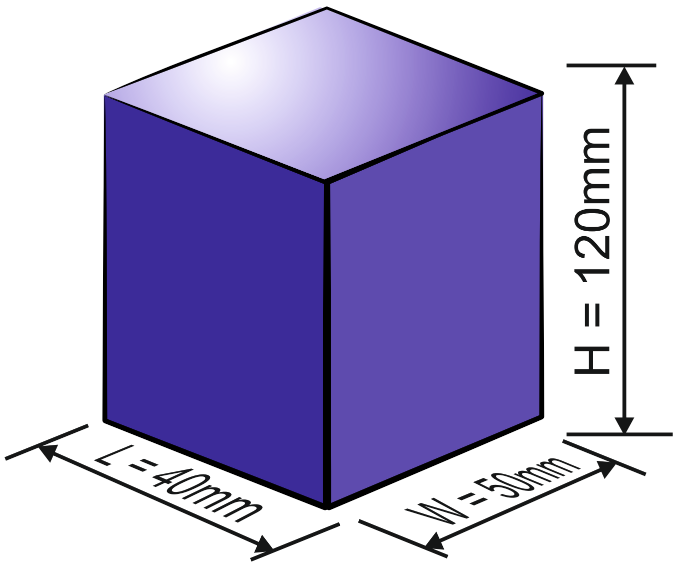
$$V = 50 \times 40 \times 100$$

$$V = 200000mm^3$$

or

$$V = 200cm^3$$

EXAM QUESTION - RECTANGULAR PRISM



What is the volume of the rectangular prism shown opposite?

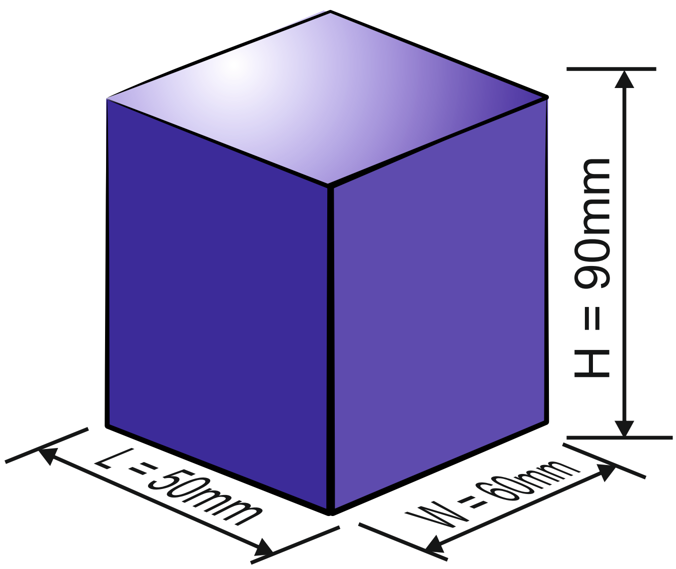
$$V = L \times W \times H$$

$$V = 40 \times 50 \times 120$$

$$V = 240000mm^3$$

or

$$V = 240cm^3$$



What is the volume of the rectangular prism shown opposite?

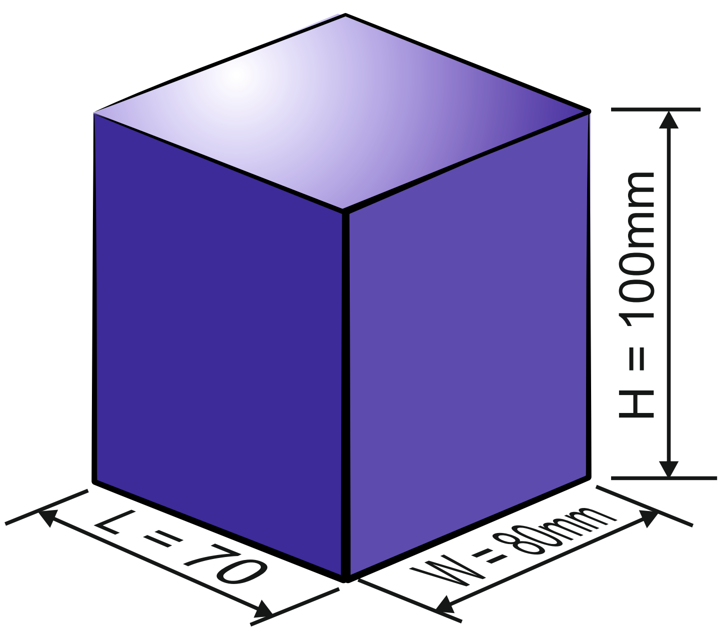
$$V = L \times W \times H$$

$$V = 50 \times 60 \times 90$$

$$V = 270000mm^3$$

or

$$V = 270cm^3$$



What is the volume of the rectangular prism shown opposite?

$$V = L \times W \times H$$

$$V = 70 \times 80 \times 100$$

$$V = 560000mm^3$$

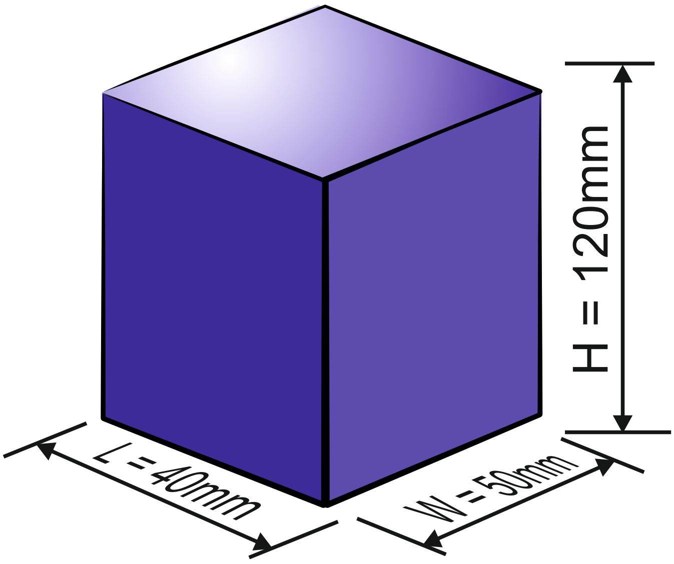
or

$$V = 560cm^3$$

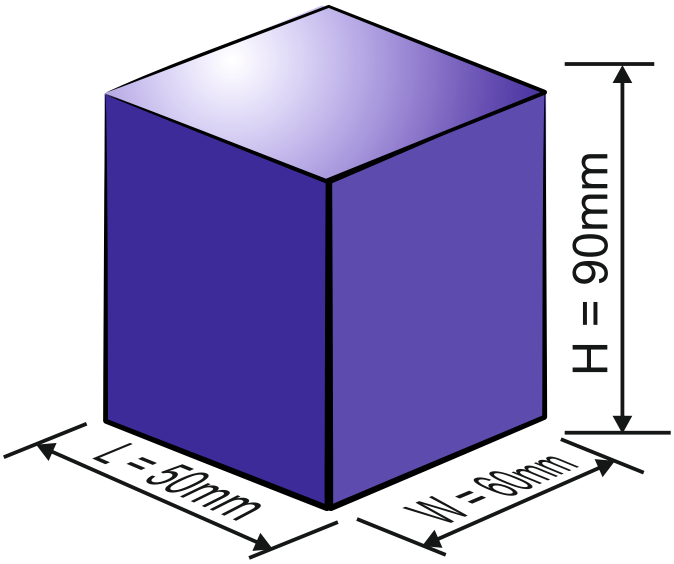
EXAM QUESTION - RECTANGULAR PRISM

Calculate the volume of each rectangular prism, shown below.

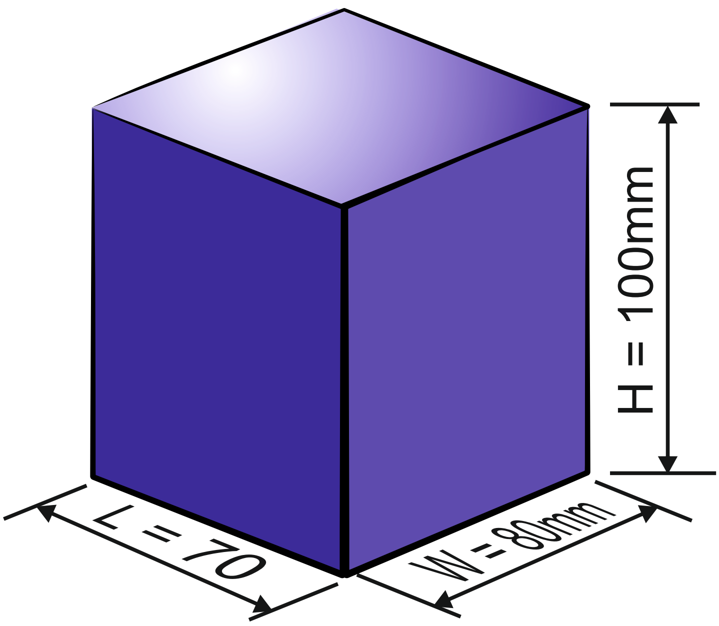
$V = L \times W \times H$



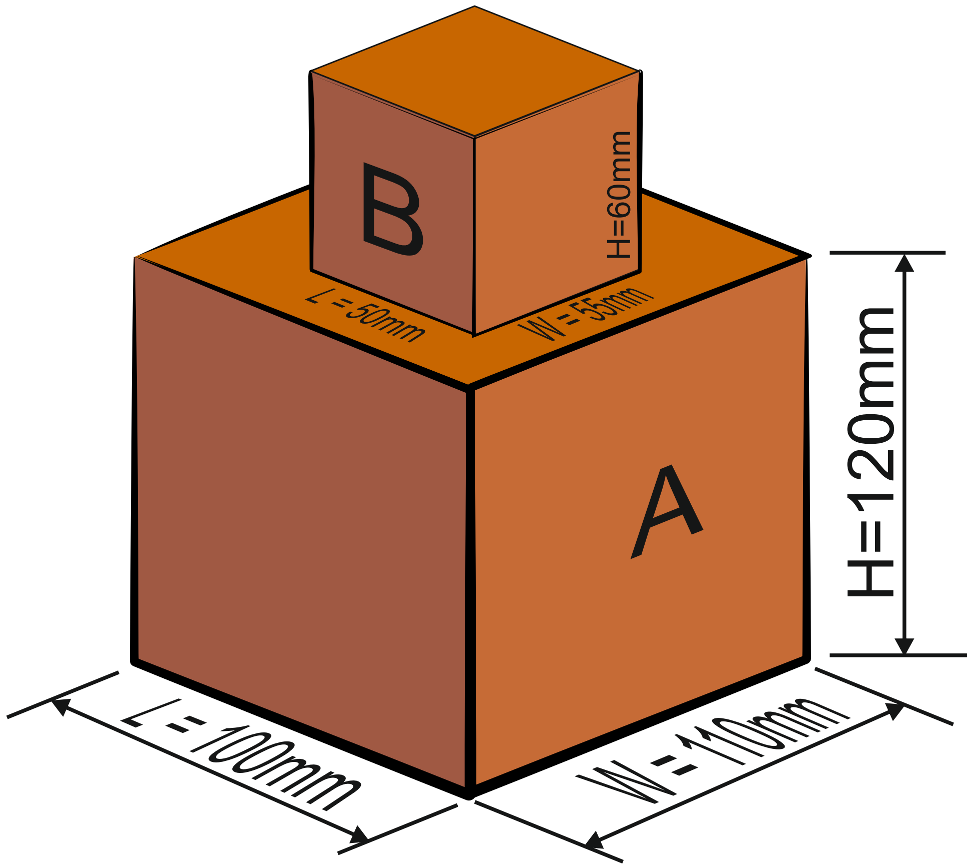
$V = L \times W \times H$



$V = L \times W \times H$



EXAM QUESTION - RECTANGULAR PRISM



The solid geometrical shape shown opposite can be treated as two rectangular prisms.

Calculate the entire volume of the shape/form

Explain your working out.

First, treat the shape / form as two separate rectangular prisms, Prism A and Prism B

Work out the volume of rectangular prism A and B

VOLUME OF 'A'
V=L x W x H

VOLUME = 100mm x 110mm x 120mm
VOLUME = 1320000mm^3 or 1320cm^3

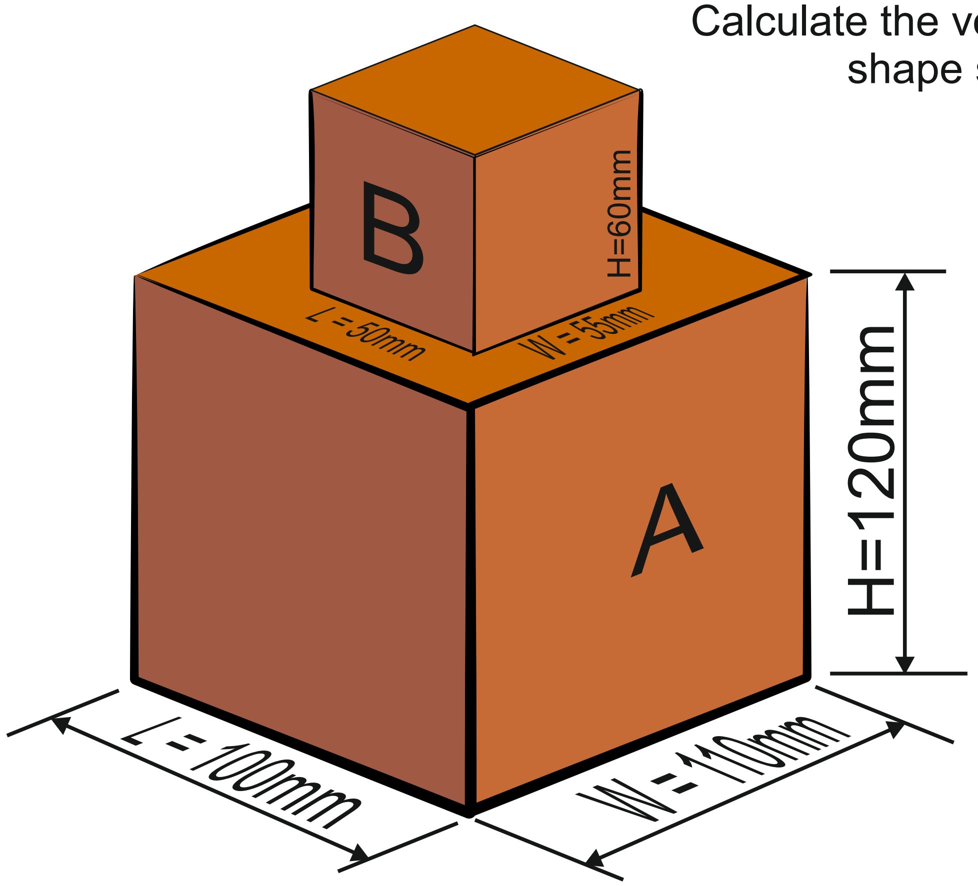
VOLUME OF 'B'
V=L x W x H

VOLUME = 50mm x 55mm x 60mm
VOLUME = 165000mm^3 or 165cm^3

Then, add the volume of rectangular prism A and the volume of rectangular prism B, to find the final overall volume.

FINAL VOLUME = A + B
FINAL VOLUME = 1320000mm^3 + 165000mm^3
FINAL VOLUME = 1485000mm^3 or 1485cm^3

EXAM QUESTION - RECTANGULAR CUBE



Calculate the volume of the geometrical shape shown opposite.

The unusual solid geometrical shape shown opposite can be treated as two rectangular prisms.

Calculate the entire volume of the shape/form

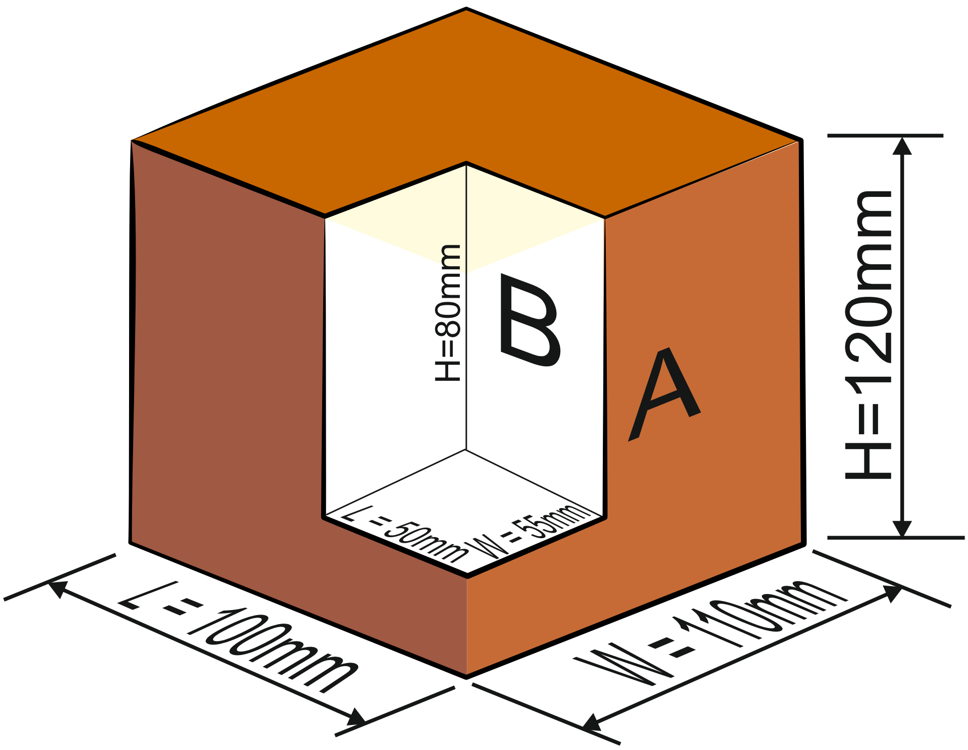
.

Explain your working out.

EXAM QUESTION - RECTANGULAR PRISMS

The ususal geometrical shape below, was a single aluminium rectangular prism. A section (section B) was then machined away to produce the shape we now see.

What is the volume of the finished 3D shape? Explain your working out.



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To answer this question, the best approach is to treat the rectangular prism as two separate rectangular prisms, A and B. The length, width and height of each of the prisms can be clearly seen on the diagram above.

How to work out the answer:

Start by treating both A and B as solid rectangular prisms.
Work out the volume of each rectangular A and B

'A'	'B'
V=L x W x H	V=L x W x H
VOLUME =100mm x 110mm x 120mm	VOLUME =50mm x 55mm x 80mm
VOLUME = 1320000mm³ or 1320cm³	VOLUME = 220000mm³ or 220cm³

Then, subtract the volume of B from the volume of A, to find the final overall volume of the geometrical shape.

FINAL VOLUME = A - B

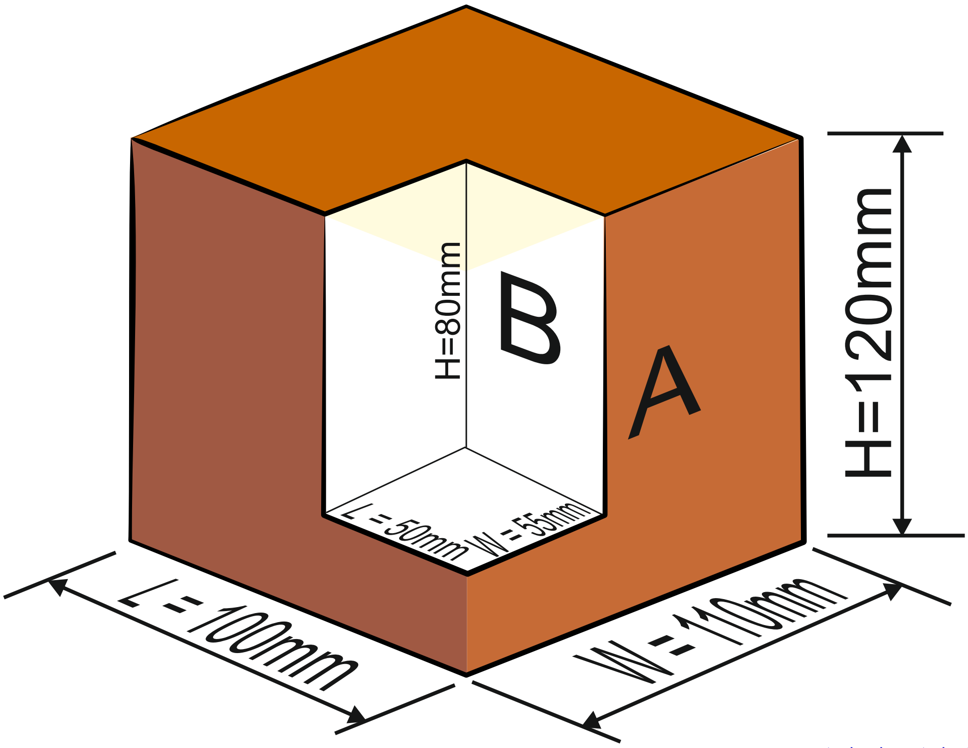
FINAL VOLUME = 1320000mm³ - 220000mm³

FINAL VOLUME = 1100000mm³ or 1100cm³

EXAM QUESTION - RECTANGULAR PRISMS

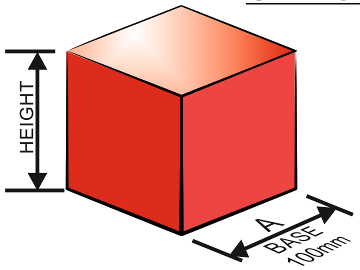
The ususal geometrical shape below, was a single aluminium rectangular prism. A section (section B) was then machined away to produce the shape we now see.

What is the volume of the finished 3D shape? Explain your working out.



MATHEMATICS - VOLUMES - REVISION CARDS

HOW TO CALCULATE THE VOLUME OF A CUBE



DEFINITION: A cube is a solid object, composed of six equal squares, with a 90 degree angle between adjacent sides.

All the sides of a cube are the same measurement. There are two similar formulas for calculating a cube's volume.

VOLUME (V) =A x A x A OR A^3

EXAMPLE 1

If the measurement of one side is 100mm:

VOLUME = 100mm x 100mm x 100mm

VOLUME = 1000000mm³ or 1000cm³

EXAMPLE 2

If the measurement of one side is 320mm:

VOLUME = 320mm x 320mm x 320mm

VOLUME =32768000mm³ or 32768cm³

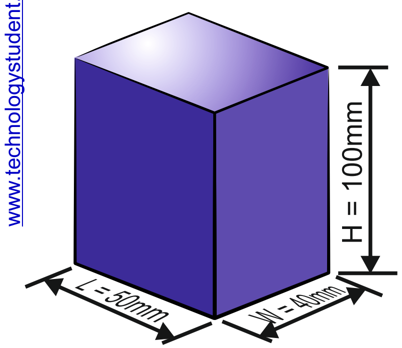
HOW TO CALCULATE THE VOLUME OF A RECTANGULAR PRISM

DEFINITION: A rectangular prism is a solid object, composed of six rectangles, with a 90 degree angle between adjacent sides. Opposite sides of a rectangular prism are equal and parallel.

Unlike a cube, the area of the sides of a rectangular prism / cuboid are not the same, consequently the formula for calculating the volume is as follows:

VOLUME = LENGTH X WIDTH X HEIGHT

V=L x W x H



EXAMPLE: What is the volume of the rectangular prism shown opposite?

V=L x W x H

V=50 x 40 x 100

V=200000mm³

or

V=200cm³

HOW TO CALCULATE THE VOLUME OF A CYLINDER

DEFINITION: A three dimensional geometrical shape, that has a circle at each end of a single curved surface.

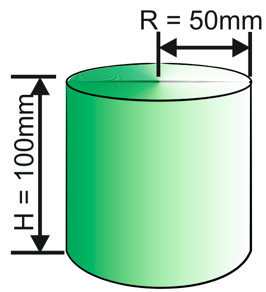
FIRST, AREA OF A CIRCLE = π X R^2

CIRCUMFERENCE = 2 X π X R

In order to calculate the volume of a cylinder, the height and radius of the circular top /bottom must be known. The following formula is used to calculate the volume.

π (pi) = 3.14 $v = \pi r^2 h$

volume (v) = pi x radius² x height



v = 3.14x 50mmx50mmx100mm

v = 785000mm³

or

v = 785cm³

MATHEMATICS - VOLUMES - REVISION CARDS

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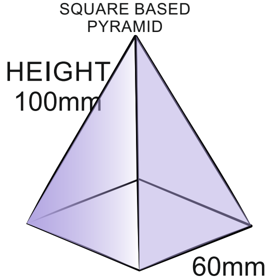
HOW TO CALCULATE THE VOLUME OF A REGULAR SQUARE PYRAMID

DEFINITION: A Regular Square Pyramid has a square base with triangular sides. The apex (highest point), is in line with the centre of the square base.

FORMULA

$$\text{Volume} = \frac{1}{3} \times \text{Base} \times \text{Height}$$

$$V = \frac{1}{3} \times B \times H$$



CALCULATE THE AREA OF BASE FIRST

AREA OF BASE = LENGTH^2

AREA OF BASE = 60mm X 60mm = 3600mm^2

THEN APPLY THE FOLLOWING FORMULA

$$\text{Volume} = \frac{1}{3} \times \text{Base} \times \text{Height}$$

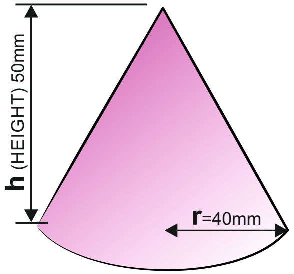
$$V = \frac{1}{3} \times 3600\text{mm} \times 100\text{mm}$$

$$V = \frac{1}{3} \times 360000\text{mm}$$

$$V = \frac{360000\text{mm}}{3} = 120000\text{mm}^3$$

HOW TO CALCULATE THE VOLUME OF A CONE

DEFINITION: A cone has one surface with a circular base. The vertex is directly above the centre of the circular base.



FORMULA

$$v = 1/3\ \pi r^2 h$$

the same as $v = \frac{\pi r^2 h}{3}$

pi (π) is 3.14

If the height (h) is 50mm and the radius is 40mm

Then:

$$v = 1/3\ \pi r^2 h$$

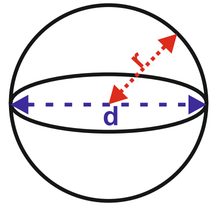
$$v = \frac{1}{3} \times 3.14 \times (40 \times 40) \times 50$$

$$v = \frac{1}{3} \times 251200$$

$$v = \frac{25177}{3} = 83733.33\text{mm}^3$$

HOW TO CALCULATE THE VOLUME OF A SPHERE

DEFINITION: A sphere is an object that is absolutely symmetrical about it's centre. From any angle it appears to be a circle, but it is a true three dimensional object.



FORMULA

$$v = 4/3 \pi r^3$$

EXAMPLE CALCULATION

$$V = 4/3 \pi r^3$$

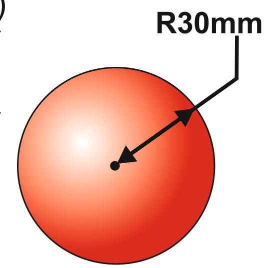
$$V = \frac{4}{3} \times \frac{3.14 \times (30 \times 30 \times 30)}{1}$$

$$V = \frac{4}{3} \times \frac{3.14 \times (27000)}{1}$$

$$V = \frac{4}{3} \times \frac{84780}{1}$$

$$V = \frac{339120}{3}$$

$$V = 113040\text{mm}^3$$



MATHEMATICAL SKILLS

VOLUME OF A SPHERE

DESIGN AND TECHNOLOGY

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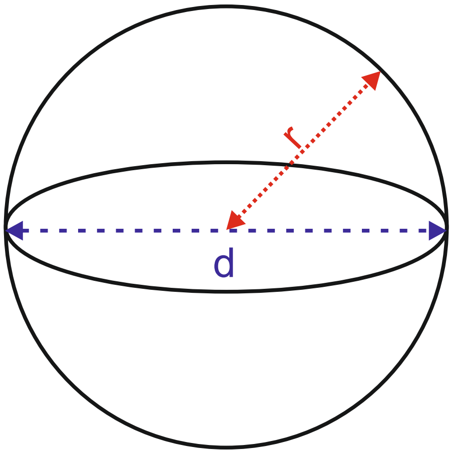
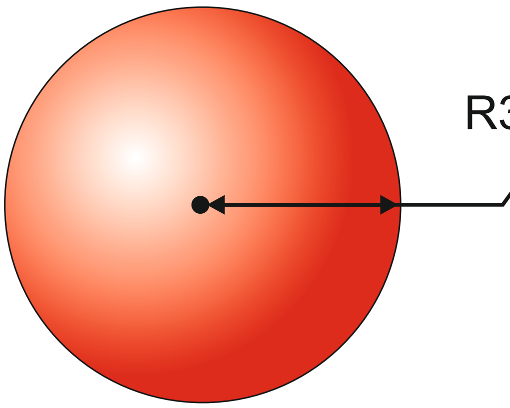
DEFINITION: A sphere is an object that is absolutely symmetrical about it's centre. From any angle it appears to be a circle, but it is a true three dimensional object.



FORMULA

$$v=4/3\pi r^3$$

EXAMPLE CALCULATION - VOLUME OF A SPHERE



$$v=4/3\pi r^3$$

$$v = \frac{4}{3} \times \frac{3.14 \times (30 \times 30 \times 30)}{1}$$

$$v = \frac{4}{3} \times \frac{3.14 \times (27000)}{1}$$

$$v = \frac{4}{3} \times \frac{84780}{1}$$

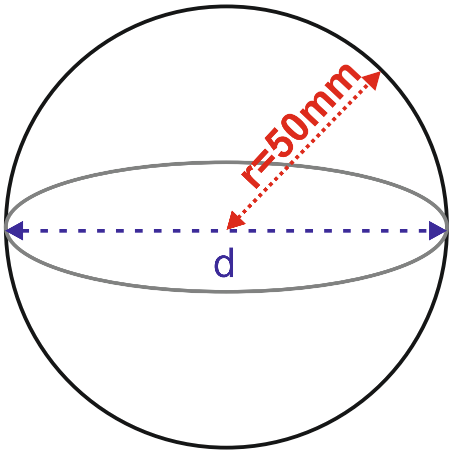
$$v = \frac{339120}{3}$$

$$v = 113040\text{mm}^3$$

FORMULA

$v=4/3\pi r^3$

Using the formula shown opposite, calculate the volumes of the following spheres. **(pi (π) is 3.14)**



$v=4/3\pi r^3$

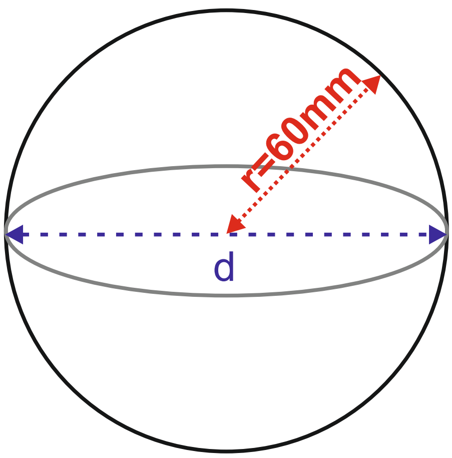
$$v = \frac{4}{3} \times \frac{3.14 \times (50 \times 50 \times 50)}{1}$$

$$v = \frac{4}{3} \times \frac{3.14 \times (125000)}{1}$$

$$v = \frac{4}{3} \times \frac{392500}{1}$$

$$v = \frac{1570000}{3}$$

$$v = 523333.33mm^3$$



$v=4/3\pi r^3$

$$v = \frac{4}{3} \times \frac{3.14 \times (60 \times 60 \times 60)}{1}$$

$$v = \frac{4}{3} \times \frac{3.14 \times (216000)}{1}$$

$$v = \frac{4}{3} \times \frac{678240}{1}$$

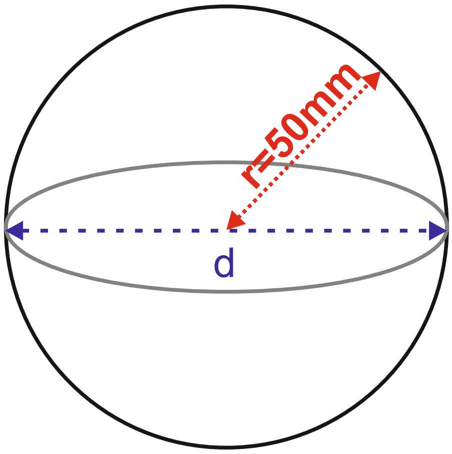
$$v = \frac{2712960}{3}$$

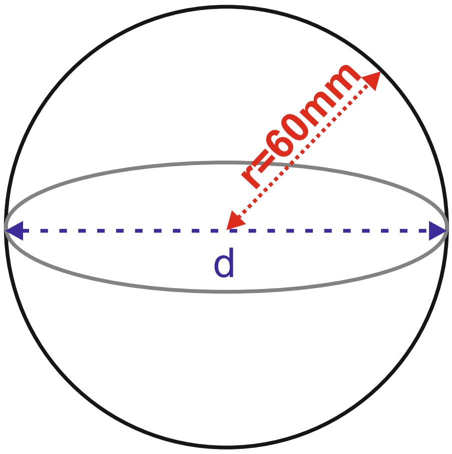
$$v = 904320mm^3$$

FORMULA

$v=4/3\pi r^3$

Using the formula shown opposite, calculate the volumes of the following spheres. **(pi (π) is 3.14)**



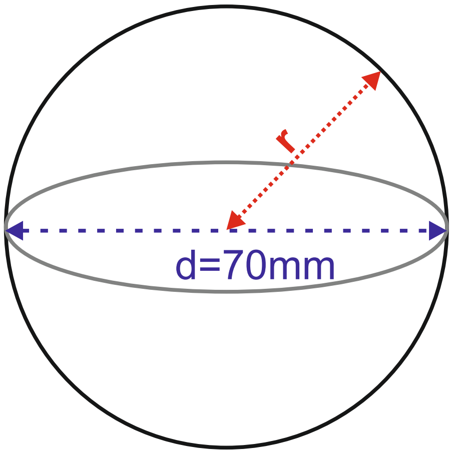


EXAMINATION QUESTIONS - VOLUME OF A SPHERE

FORMULA

$$v=4/3\pi r^3$$

Using the formula shown opposite, calculate the volumes of the following spheres. **(pi (π) is 3.14)**



d= 70mm therefore r = 35mm

$$v=4/3\pi r^3$$

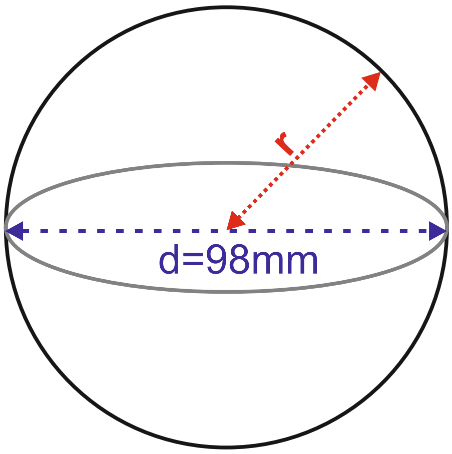
$$v= \frac{4}{3} \times \frac{3.14 \times (35\times35\times35)}{1}$$

$$v= \frac{4}{3} \times \frac{3.14 \times (42875)}{1}$$

$$v= \frac{4}{3} \times \frac{134627.5}{1}$$

$$v= \frac{538510}{3}$$

$$v= 179503.33mm^3$$



d= 98mm therefore r = 49mm

$$v=4/3\pi r^3$$

$$v= \frac{4}{3} \times \frac{3.14 \times (49\times49\times49)}{1}$$

$$v= \frac{4}{3} \times \frac{3.14 \times (117649)}{1}$$

$$v= \frac{4}{3} \times \frac{369417.86}{1}$$

$$v= \frac{1477671.44}{3}$$

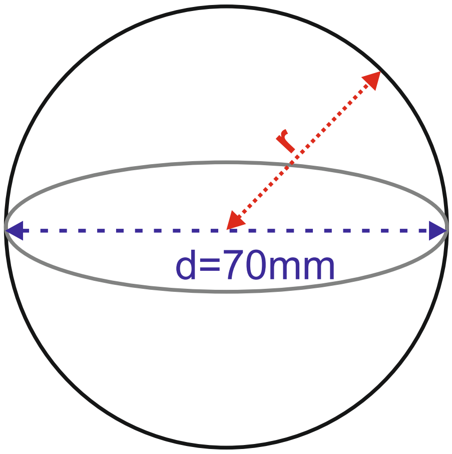
$$v= 492557.15mm^3$$

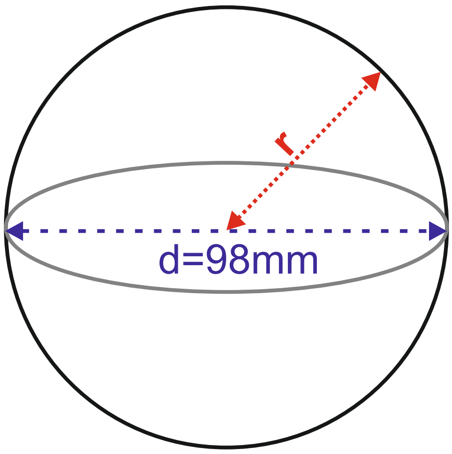
EXAMINATION QUESTIONS - VOLUME OF A SPHERE

FORMULA

$$v=4/3\pi r^3$$

Using the formula shown opposite, calculate the volumes of the following spheres.**(pi (π) is 3.14)**





MATHEMATICAL SKILLS

GEARS, GEAR TRAINS AND COMPOUND GEARS

ASSOCIATED EXAMINATION QUESTIONS

DESIGN AND TECHNOLOGY

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CALCULATING GEAR RATIO (VELOCITY RATIO)

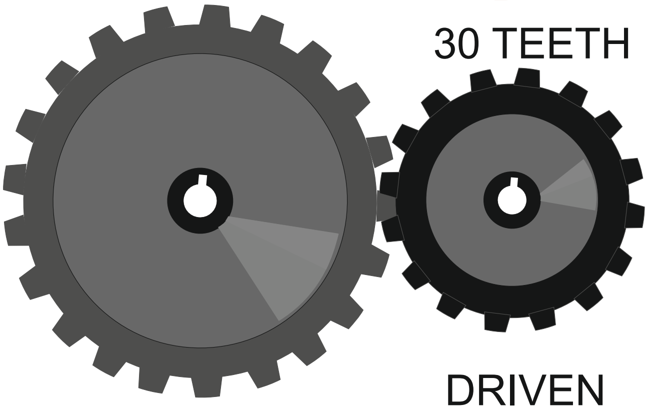
In examinations, one of the first questions will be - to work out the 'gear ratio' (sometimes called velocity ratio). As a guide - always assume that the larger gear revolves one revolution. The number of rotations of the second gear has then to be worked out.

1A.

In the example below, the DRIVER has 60 teeth and because it is the largest we say that it revolves once. The DRIVEN gear has 30 teeth. Simply divide 60 teeth by 30 teeth to work out the number of revolutions of the driven gear.

A
60 TEETH

B
30 TEETH



DRIVER
(EFFORT)

DRIVEN
(LOAD)

GEAR RATIO / VELOCITY RATIO

$$\frac{\text{Distance moved by Effort}}{\text{Distance moved by Load}} = \frac{\text{60T (GEAR A)}}{\text{30T (GEAR B)}}$$

$$= \frac{1}{2} = \frac{\text{Input movement}}{\text{Output movement}}$$

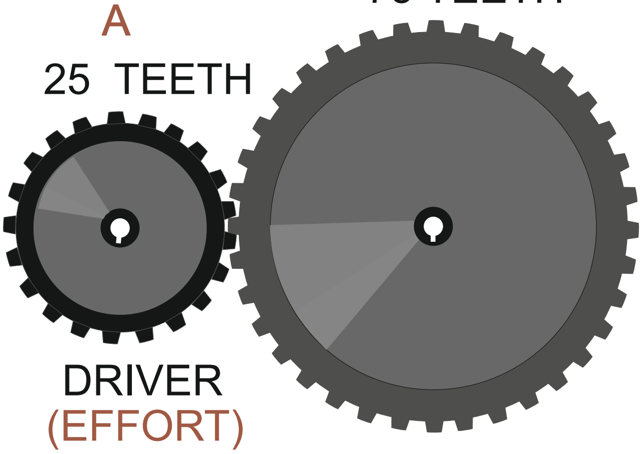
= Driver : Driven

1 : 2

2A.

A
25 TEETH

B
75 TEETH



DRIVER
(EFFORT)

DRIVEN
(LOAD)

$$\frac{\text{Distance moved by Effort}}{\text{Distance moved by Load}} = \frac{\text{25T (GEAR A)}}{\text{75T (GEAR B)}}$$

$$= \frac{3}{1} = \frac{\text{Input movement}}{\text{Output movement}}$$

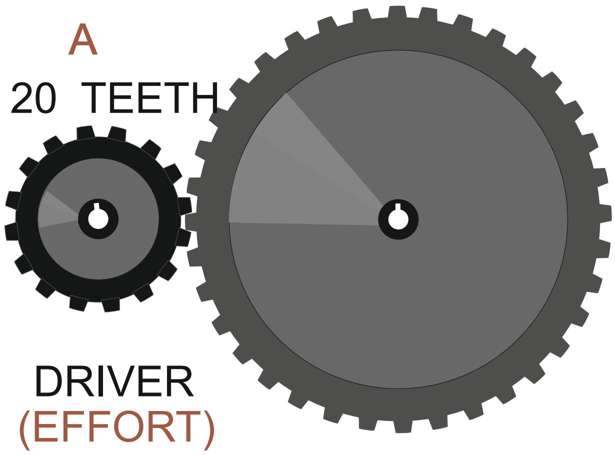
= Driver : Driven

3 : 1

3A.

A
20 TEETH

B
80 TEETH



DRIVER
(EFFORT)

DRIVEN
(LOAD)

$$\frac{\text{Distance moved by Effort}}{\text{Distance moved by Load}} = \frac{\text{20T (GEAR A)}}{\text{80T (GEAR B)}}$$

$$= \frac{4}{1} = \frac{\text{Input movement}}{\text{Output movement}}$$

= Driver : Driven

4 : 1

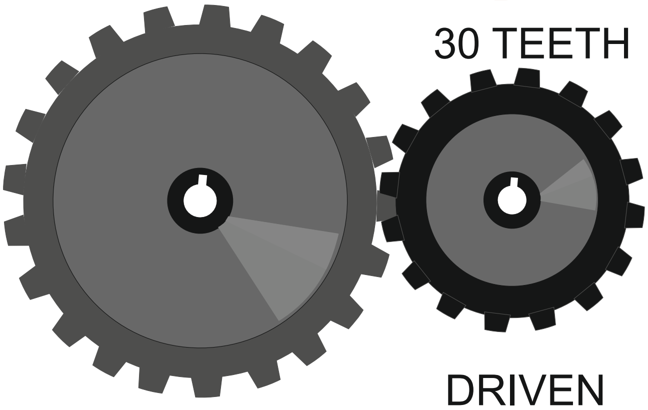
CALCULATING GEAR RATIO (VELOCITY RATIO)

In examinations, one of the first questions will be - to work out the 'gear ratio' (sometimes called velocity ratio). As a guide - always assume that the larger gear revolves one revolution. The number of rotations of the second gear has then to be worked out.

1A.

A
60 TEETH

B
30 TEETH



DRIVER
(EFFORT)

DRIVEN
(LOAD)

GEAR RATIO / VELOCITY RATIO

Distance moved by Effort / Distance moved by Load = ______

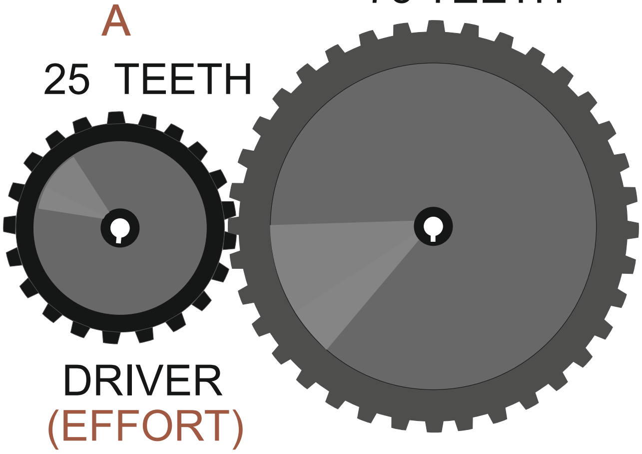
= — = Input movement / Output movement

= Driver : Driven
:

2A.

B
75 TEETH

A
25 TEETH



DRIVER
(EFFORT)

DRIVEN
(LOAD)

Distance moved by Effort / Distance moved by Load = ______

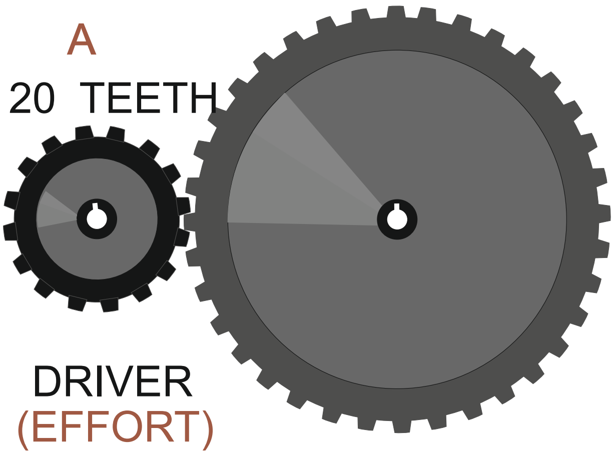
= — = Input movement / Output movement

= Driver : Driven
:

3A.

B
80 TEETH

A
20 TEETH



DRIVER
(EFFORT)

DRIVEN
(LOAD)

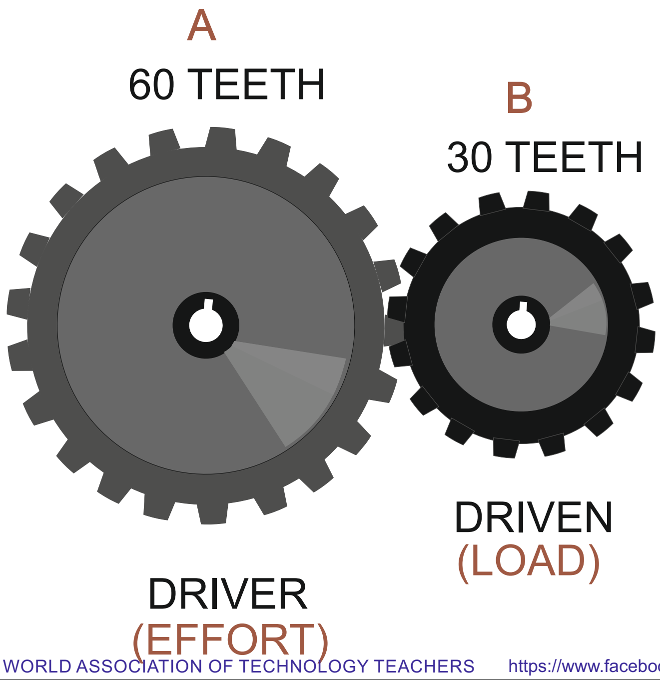
Distance moved by Effort / Distance moved by Load = ______

= — = Input movement / Output movement

= Driver : Driven
:

CALCULATING REVOLUTIONS PER MINUTE (RPM)

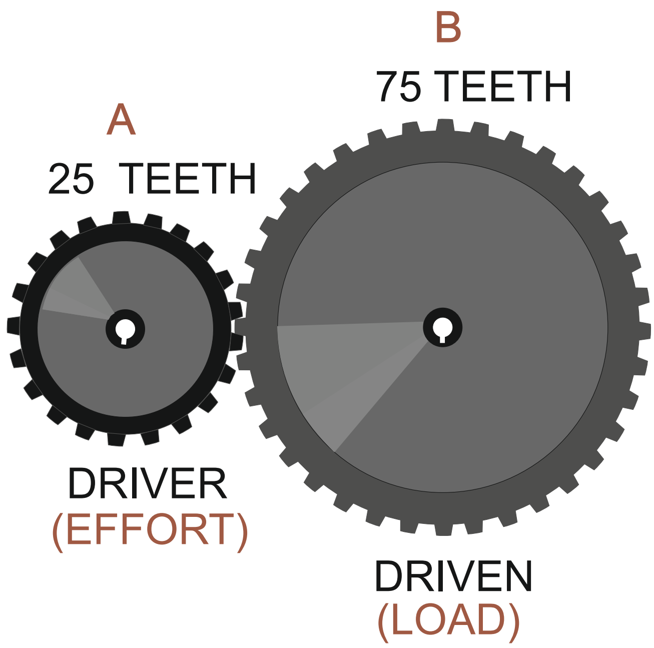
In the example below, the DRIVER gear is larger than the DRIVEN gear. The general rule is - large to small gear means 'multiply' the velocity ratio by the rpm of the first gear. Divide 60 teeth by 30 teeth to find the velocity ratio. Multiply this number (2) by the rpm (120). This gives an answer of 240rpm.



GEAR A	GEAR B
60 teeth	30 teeth
120 rpm	?

$$\frac{60}{30} = 2$$

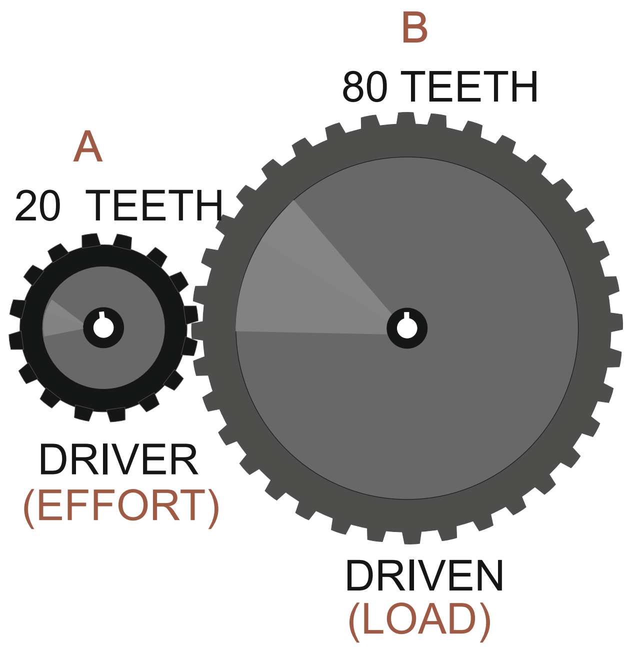
$$= 120 \times 2 = 240 \text{ revs/min}$$



GEAR A	GEAR B
25 teeth	75 teeth
60 rpm	?

$$\frac{75}{25} = 3$$

$$= \frac{60}{3} = 20 \text{ revs/min}$$

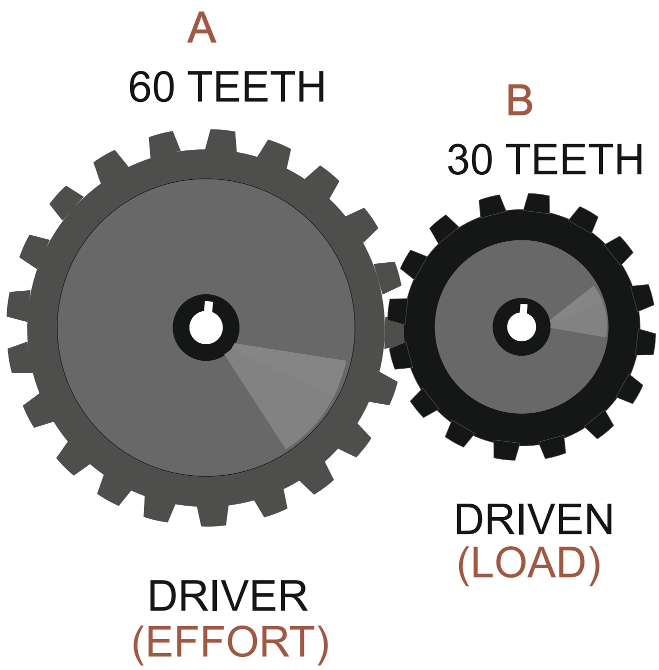


GEAR A	GEAR B
20 teeth	80 teeth
100 rpm	?

$$\frac{80}{20} = 4$$

$$= \frac{100}{4} = 25 \text{ revs/min}$$

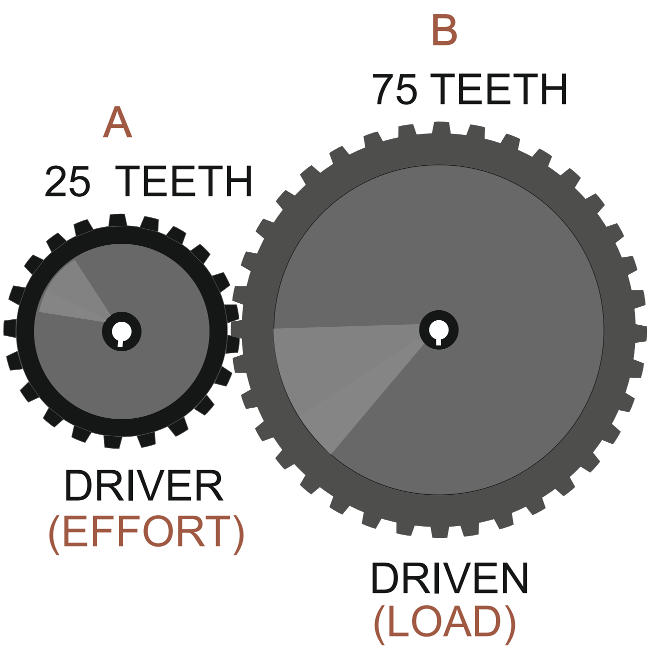
CALCULATING REVOLUTIONS PER MINUTE (RPM)



GEAR A	GEAR B
60 teeth	30 teeth
120 rpm	

— =

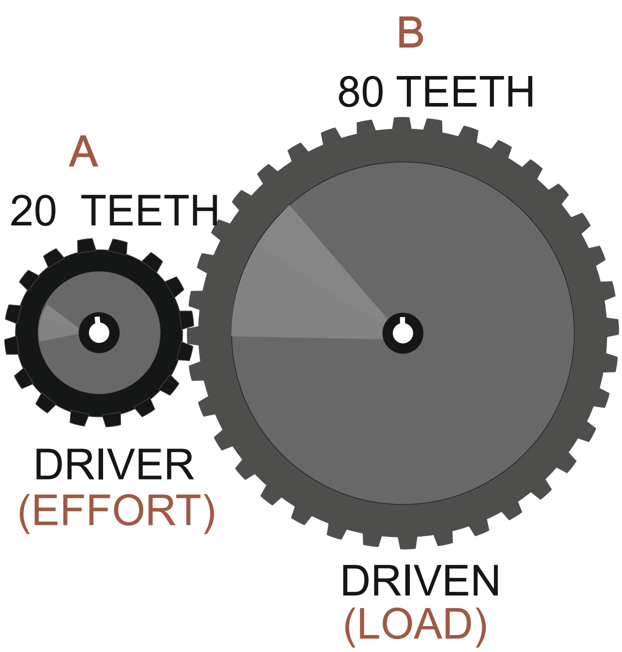
= = revs/min



GEAR A	GEAR B
25 teeth	75 teeth
60 rpm	

— =

= — = revs/min



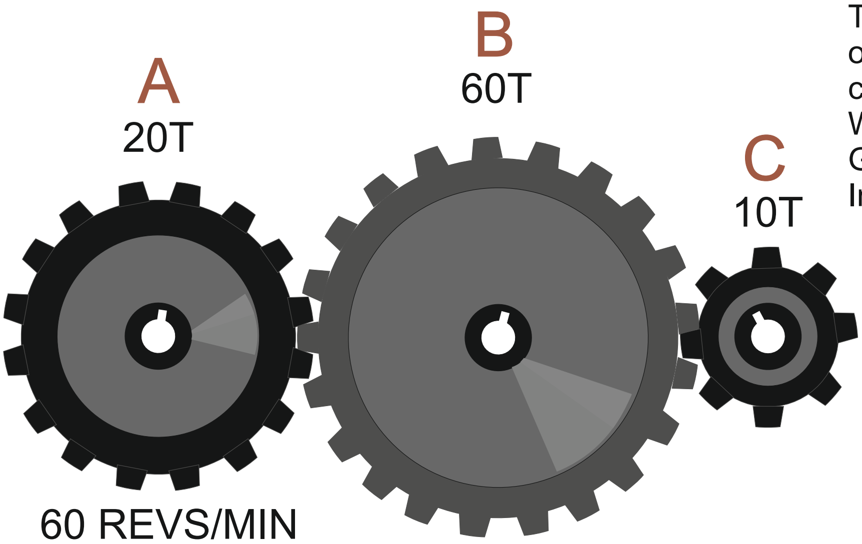
GEAR A	GEAR B
20 teeth	80 teeth
100 rpm	

— =

= — = revs/min

GEAR TRAINS - EXAMPLE QUESTIONS AND ANSWERS

When faced with three gears, the question can be broken down into two parts. First work on Gears A and B. When this has been solved, work on gears B and C.



The diagram above shows a gear train composed of three gears. Gear A revolves at 60 revs/min in a clockwise direction.
What is the output in revolutions per minute at Gear C?
In what direction does Gear C revolve ?

GEAR A	GEAR B	GEAR C
20 teeth	60 teeth	10 teeth
60 rpm	?	?

First work out the speed at Gear B.

$$\frac{60\ \text{teeth}}{20\ \text{teeth}}\ \frac{B}{A} = 3$$

$$= \frac{60\text{rpm}}{3} = 20 \text{ revs/min at 'B'}$$

(Remember B is larger than A therefore, B outputs less revs/min and is slower)

Next, take B and C. C is smaller, therefore, revs/minute will increase and rotation will be faster.

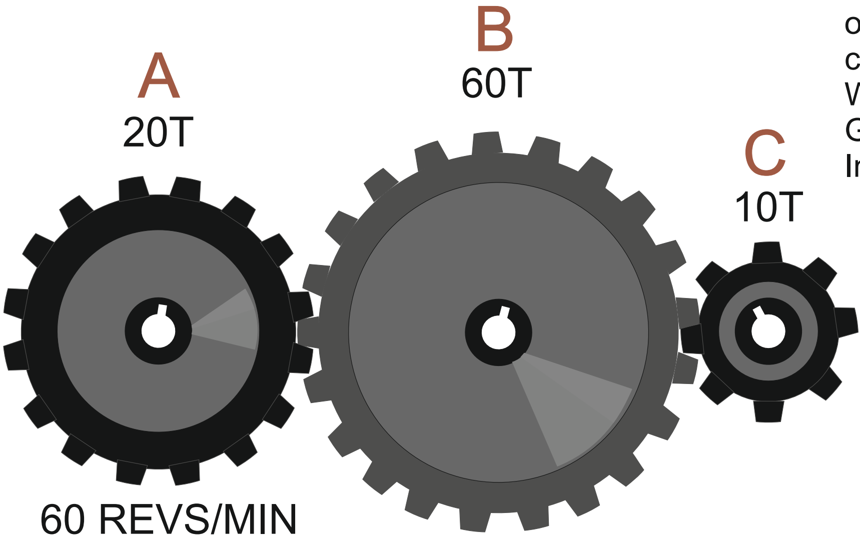
$$\frac{60\ \text{teeth}}{10\ \text{teeth}}\ \frac{B}{C} = 6$$

$$20 \text{ REVS X } 6 = 120 \text{ revs/min at 'C'}$$

What direction does C revolve ?
A is clockwise, B consequently is anti-clockwise and C is therefore clockwise.

GEAR TRAINS - EXAMPLE QUESTIONS

When faced with three gears the question can be broken down into two parts. First work on Gears A and B. When this has been solved work on gears B and C.



The diagram above shows a gear train composed of three gears. Gear A revolves at 60 revs/min in a clockwise direction.
What is the output in revolutions per minute at Gear C?
In what direction does Gear C revolve ?

GEAR A	GEAR B	GEAR C
20 teeth	60 teeth	10 teeth
60 rpm		

First work out the speed at Gear B.

$$\frac{\_\_\ \text{teeth}\ B}{\_\_\ \text{teeth}\ A} =$$

$$= \frac{60\text{rpm}}{\_\_} = \_\_\_\ \text{revs/min at 'B'}$$

(Remember B is larger than A therefore, B outputs less revs/min and is slower)

Next, take B and C. C is smaller, therefore, revs/minute will increase and rotation will be faster.

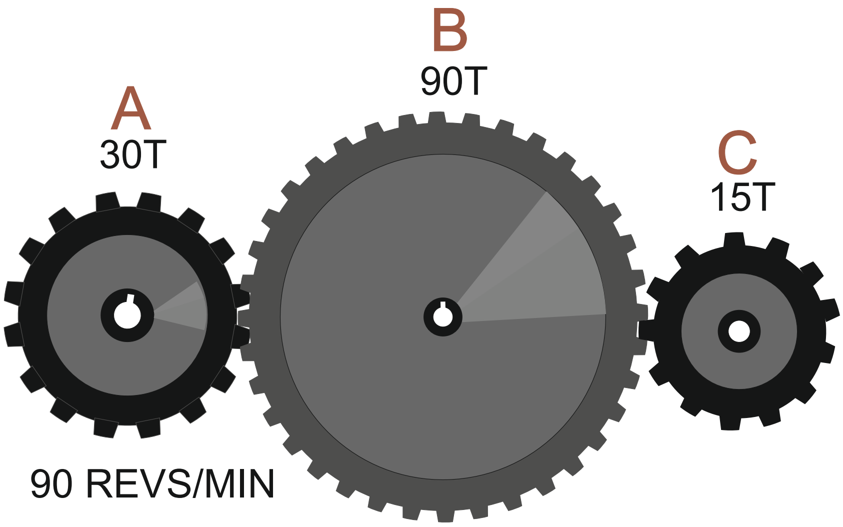
$$\frac{\_\_\ \text{teeth}\ B}{\_\_\ \text{teeth}\ C} =$$

$$\_\_\text{REVS X}\ \_\_ = \_\_\_\_\ \text{revs/min at 'C'}$$

What direction does C revolve ?
A is clockwise, B consequently is anti-clockwise and C is therefore _______________

GEAR TRAINS - EXAMPLE QUESTIONS AND ANSWERS

When faced with three gears the question can be broken down into two parts. First work on Gears A and B. When this has been solved work on gears B and C.



The diagram opposite shows a gear train composed of three gears. Gear A revolves at 90 revs/min in a clockwise direction.
What is the output in revolutions per minute at Gear C?
In what direction does Gear C revolve ?

GEAR A	GEAR B	GEAR C
30 teeth	90 teeth	15 teeth
90 rpm	?	?

First work out the speed at Gear B.

$$\frac{90 \text{ teeth}}{30 \text{ teeth}} \; \frac{B}{A} = 3$$

$$= \frac{90 \text{rpm}}{3} = 30 \text{ revs/min at 'B'}$$

(Remember B is larger than A therefore, B outputs less revs/min and is slower)

Next, take B and C. C is smaller, therefore, revs/minute will increase and rotation will be faster.

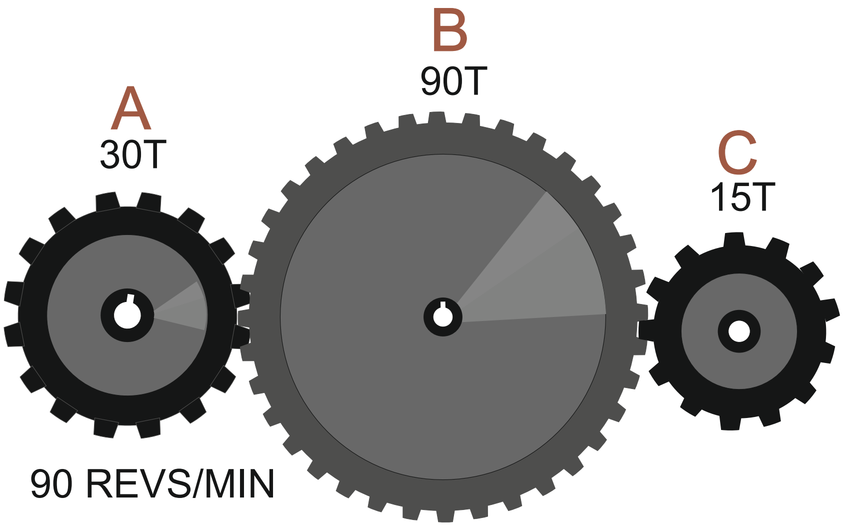
$$\frac{90 \text{ teeth}}{15 \text{ teeth}} \; \frac{B}{C} = 6$$

$$30 \text{ REVS X } 6 = 180 \text{ revs/min at 'C'}$$

What direction does C revolve ?
A is clockwise, B consequently is anti-clockwise and C is therefore clockwise.

GEAR TRAINS - EXAMPLE QUESTIONS AND ANSWERS

When faced with three gears the question can be broken down into two parts. First work on Gears A and B. When this has been solved work on gears B and C.



The diagram opposite shows a gear train composed of three gears. Gear A revolves at 90 revs/min in a clockwise direction.
What is the output in revolutions per minute at Gear C?
In what direction does Gear C revolve ?

GEAR A	GEAR B	GEAR C
30 teeth	90 teeth	15 teeth
90 rpm		

First work out the speed at Gear B.

$$\frac{\_\_}{\_\_}\ \frac{\text{teeth B}}{\text{teeth A}} =$$

$$= \frac{90\text{rpm}}{\_\_} = \_\_\_\_ \text{ revs/min at 'B'}$$

(Remember B is larger than A therefore, B outputs less revs/min and is slower)

Next, take B and C. C is smaller, therefore, revs/minute will increase and rotation will be faster.

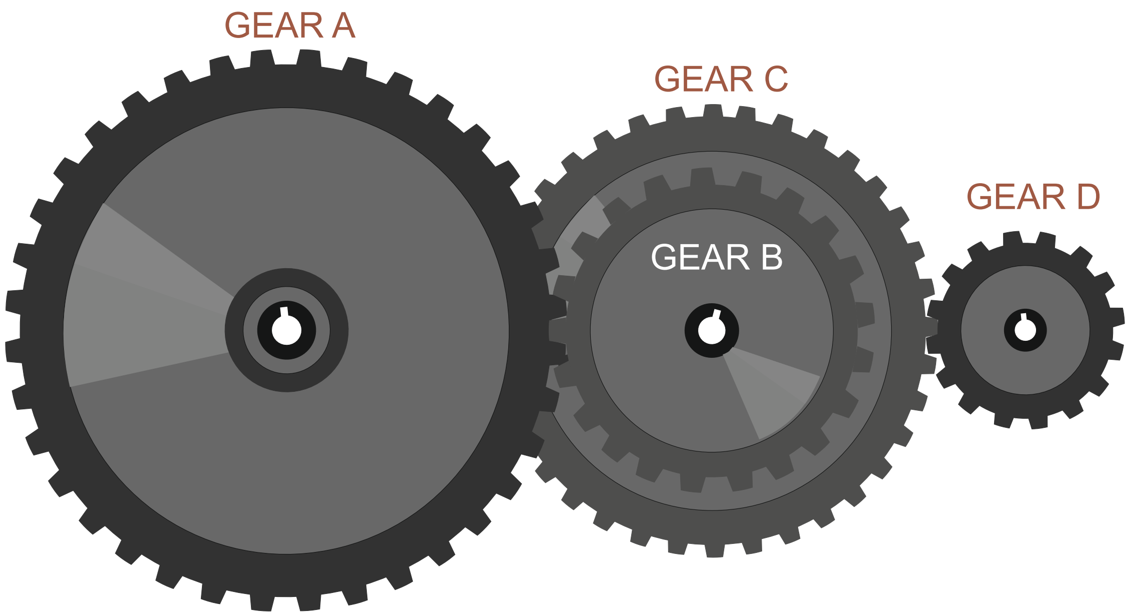
$$\frac{\_\_}{\_\_}\ \frac{\text{teeth B}}{\text{teeth C}} =$$

__ REVS X __ = ___ revs/min at 'C'

What direction does C revolve ?
A is clockwise, B consequently is anti-clockwise and C is therefore _______________

COMPOUND GEARS - EXAMPLE QUESTIONS AND ANSWERS

Below is a question regarding 'compound gears'. Gears C and B represent a compound gear as they appear 'fixed' together. When drawn with a compass they have the same centre. Two gears 'fixed' together in this way rotate together and at the same RPM. When answering a question like this split it into two parts. Treat gears A and B as one question AND C and D as the second part.



This is an example of a "compound gear train". Gear A rotates in a clockwise direction at 30 revs/min. What is the output in revs/min at D and what is the direction of rotation ?

GEAR A	GEAR B	GEAR C	GEAR D
120 teeth	40 teeth	80 teeth	20 teeth

First find revs/min at Gear B.

$$\frac{120 \text{ teeth}}{40 \text{ teeth}} \; \frac{B}{A} = 3$$

30 rpm X 3 = 90 rpm / min

B is smaller therefore it rotates faster and revs/min increase.

C is fixed to B and therefore, rotates at the same speed.

90 REVS/MIN at C

Next find revs/min at Gear D.

$$\frac{80 \text{ teeth}}{20 \text{ teeth}} \; \frac{C}{D} = 4$$

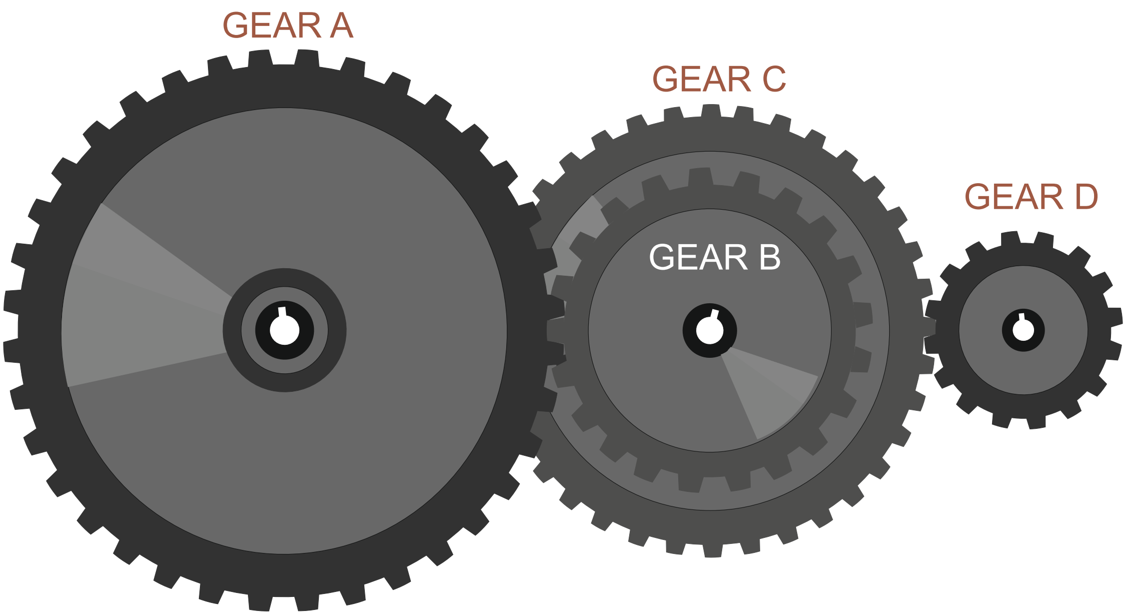
90 rpm (at C) X 4 = 360 rpm / min

D is smaller than C, therefore rotates faster (increased revs/min).

A revolves in a clockwise direction, B is therefore anti-clockwise, C is fixed to B and is also anti-clockwise, which means D revolves in a clockwise direction.

COMPOUND GEARS - EXAMPLE QUESTIONS AND ANSWERS

Below is a question regarding 'compound gears'. Gears C and B represent a compound gear as they appear 'fixed' together. When drawn with a compass they have the same centre. Two gears 'fixed' together in this way rotate together and at the same RPM. When answering a question like this split it into two parts. Treat gears A and B as one question AND C and D as the second part.



This is an example of a “compound gear train”. Gear A rotates in a clockwise direction at 30 revs/min. What is the output in revs/min at D and what is the direction of rotation ?

GEAR A	GEAR B	GEAR C	GEAR D
120 teeth	40 teeth	80 teeth	20 teeth

First find revs/min at Gear B.

$$\frac{\_\_\ \text{teeth B}}{\text{teeth A}} =$$

__ rpm X __= __ rpm / min

B is smaller therefore it rotates faster and revs/min increase.

C is fixed to B and therefore, rotates at the same speed.

__ REVS/MIN at C

Next find revs/min at Gear D.

$$\frac{\_\_\ \text{teeth C}}{\text{teeth D}} =$$

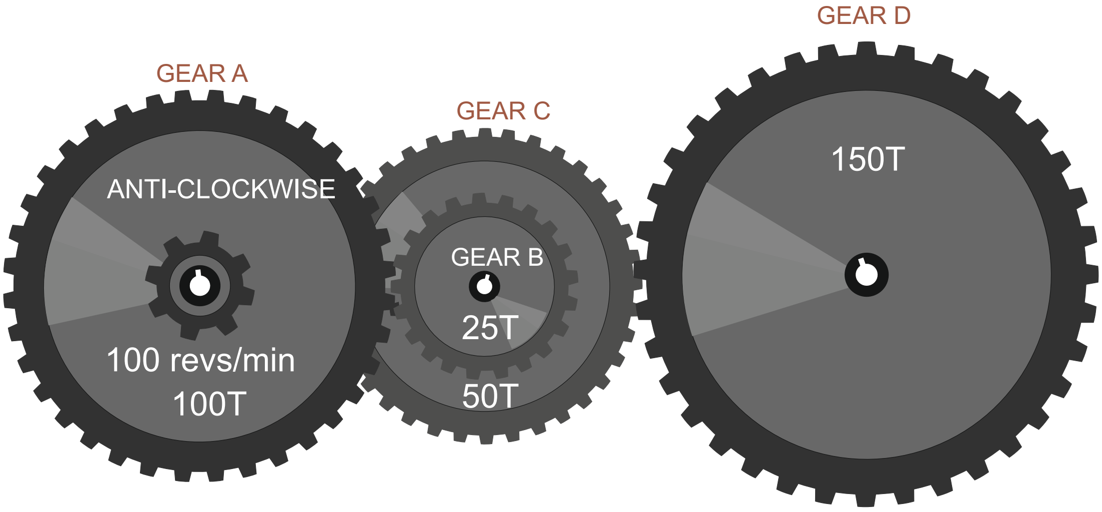
__ rpm (at C) X _ = ___ rpm / min

D is smaller than C, therefore rotates faster (increased revs/min).

A revolves in a clockwise direction, B is therefore anti-clockwise, C is fixed to B and is also anti-clockwise, which means D revolves in a __________ __direction.

COMPOUND GEARS- EXAMPLE QUESTIONS AND ANSWERS

Try the following question:



What is the revs/min at gear D and what is its direction?