Cylinder Volume & Surface Area

Practice Worksheet (Problem Solving)

I Do

A solid cylinder has a radius of 5.4 cm.
The volume of the cylinder is 1100 cm^3.

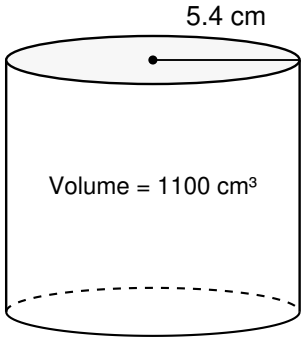


Diagram NOT accurately drawn

Calculate the total surface area of the cylinder.
Give your answer correct to 3 significant figures.

.....cm^2

(Total for Question is 4 marks)

We Do

A solid cylinder has a radius of 4.5 cm.
The volume of the cylinder is $850\,\text{cm}^3$.

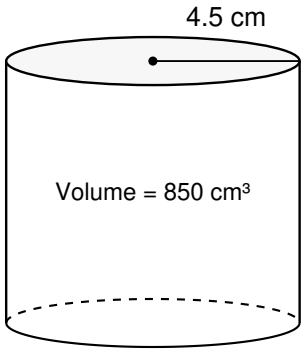


Diagram NOT accurately drawn

Calculate the total surface area of the cylinder.
Give your answer correct to 3 significant figures.

.....cm^2

(Total for Question is 4 marks)

You Do 1

A solid cylinder has a radius of 6.2 cm.
The volume of the cylinder is $1500\,\text{cm}^3$.

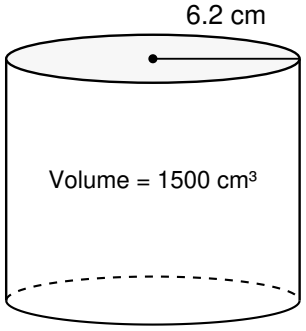


Diagram NOT accurately drawn

Calculate the total surface area of the cylinder.
Give your answer correct to 3 significant figures.

.....cm^2

(Total for Question is 4 marks)

You Do 2

A solid cylinder has a diameter of 14 cm.
The volume of the cylinder is $2000\,\text{cm}^3$.

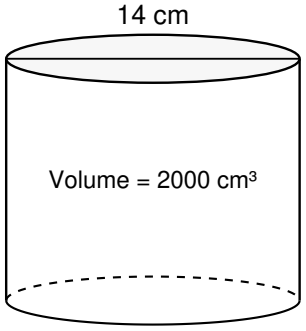


Diagram NOT accurately drawn

Calculate the total surface area of the cylinder.
Give your answer correct to 3 significant figures.

.....cm^2

(Total for Question is 4 marks)

You Do 3

A solid cylinder has a radius of 5 cm.
The total surface area of the cylinder is $450\,\text{cm}^2$.

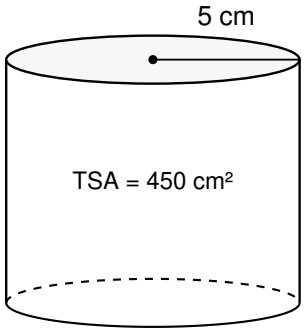


Diagram NOT accurately drawn

Calculate the volume of the cylinder.
Give your answer correct to 3 significant figures.

.....cm^3

(Total for Question is 4 marks)

Challenge 1

An open-top cylindrical container has a circular base of radius r cm and a height of $3r$ cm.
The volume of the container is 192π cm^3.

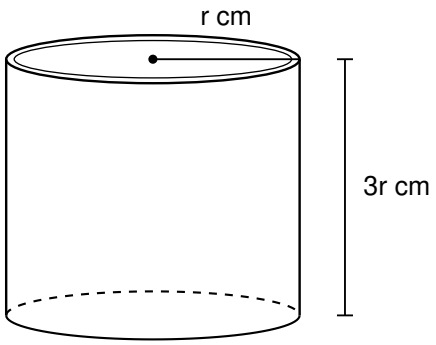


Diagram NOT accurately drawn

Calculate the total external surface area of the open-top container.
Give your answer as a multiple of π.
Show all of your working clearly.

.....cm^2

(Total for Question is 4 marks)

Challenge 2

A solid half-cylinder has a radius of 6 cm and length h cm.
The volume of the solid half-cylinder is 360π cm^3.

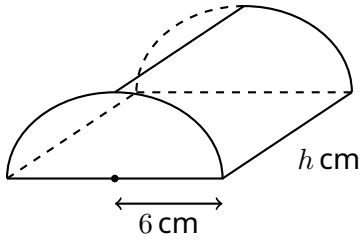


Diagram **NOT** accurately drawn

Calculate the total surface area of the solid half-cylinder.
Give your answer correct to 3 significant figures.
You must show all of your working clearly.

.....cm^2

(Total for Question is 5 marks)

Extreme Challenge

A solid cylinder has base radius r cm and height h cm, where $h = 4r$.

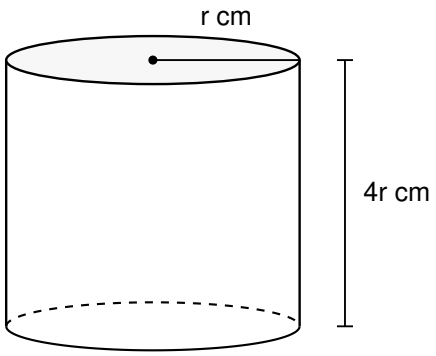


Diagram NOT accurately drawn

The numerical value of the volume of the cylinder (in cm^3) is equal to the numerical value of its total surface area (in cm^2).

Find the exact value of r, and hence find the exact volume of the cylinder in terms of π.
You must show all of your algebraic working clearly.

$r =$ ..... Volume = ...cm^3

(Total for Question is 5 marks)

Worked Answers

I Do

1. Use $V = \pi r^2 h$ to find the height h:
$1100 = \pi \times 5.4^2 \times h \implies 1100 = 29.16\pi h$
$h = \frac{1100}{29.16\pi} = 12.00757\ldots$ cm.
2. Calculate the total surface area (TSA $= 2\pi r^2 + 2\pi rh$):
Area of two circular ends $= 2 \times \pi \times 5.4^2 = 58.32\pi = 183.21768\ldots$ cm^2.
Curved surface area $= 2 \times \pi \times 5.4 \times 12.00757\cdots = 407.40740\ldots$ cm^2.
TSA $= 183.21768\cdots + 407.40740\cdots = 590.62509\ldots$ cm^2.
Correct to 3 significant figures: **591 cm^2**.

We Do

1. Find h: $850 = \pi \times 4.5^2 \times h \implies h = \frac{850}{20.25\pi} = 13.36115\ldots$ cm.
2. TSA $= 2\pi(4.5)^2 + 2\pi(4.5)(13.36115\ldots)$
TSA $= 40.5\pi + 377.77777\cdots = 127.23450\cdots + 377.77777\cdots = 505.01228\ldots$ cm^2.
Correct to 3 significant figures: **505 cm^2**.

You Do 1

1. Find h: $1500 = \pi \times 6.2^2 \times h \implies h = \frac{1500}{38.44\pi} = 12.42104\ldots$ cm.
2. TSA $= 2\pi(6.2)^2 + 2\pi(6.2)(12.42104\ldots)$
TSA $= 76.88\pi + 483.87096\cdots = 241.52564\cdots + 483.87096\cdots = 725.39661\ldots$ cm^2.
Correct to 3 significant figures: **725 cm^2**.

You Do 2

1. Radius $r = 14 \div 2 = 7$ cm.
2. Find h: $2000 = \pi \times 7^2 \times h \implies h = \frac{2000}{49\pi} = 12.99224\ldots$ cm.
3. TSA $= 2\pi(7)^2 + 2\pi(7)(12.99224\ldots)$
TSA $= 98\pi + 571.42857\cdots = 307.87608\cdots + 571.42857\cdots = 879.30465\ldots$ cm^2.
Correct to 3 significant figures: **879 cm^2**.

You Do 3

1. Use TSA $= 2\pi r^2 + 2\pi rh$:
$450 = 2\pi(5)^2 + 2\pi(5)h \implies 450 = 50\pi + 10\pi h$.
$10\pi h = 450 - 50\pi = 292.92036\ldots$
$h = \frac{292.92036\ldots}{10\pi} = 9.32394\ldots$ cm.
2. Calculate the volume:
$V = \pi \times 5^2 \times 9.32394\cdots = 25\pi \times 9.32394\cdots = 732.30091\ldots$ cm^3.
Correct to 3 significant figures: **732 cm^3**.

Challenge 1

1. Substitute $h = 3r$ into the volume formula:
$V = \pi r^2(3r) = 3\pi r^3$.
Set equal to 192π:
$3\pi r^3 = 192\pi \implies 3r^3 = 192 \implies r^3 = 64 \implies r = 4$ cm.
Therefore, $h = 3 \times 4 = 12$ cm.
2. Since the container has an open top, external surface area $= \pi r^2 + 2\pi rh$:
SA $= \pi(4)^2 + 2\pi(4)(12) = 16\pi + 96\pi =$ **112π cm^2**.

Challenge 2

1. Volume of a half-cylinder $= \frac{1}{2}\pi r^2 h$:
$\frac{1}{2}\pi(6)^2 h = 360\pi \implies 18\pi h = 360\pi \implies h = 20$ cm.
2. Total surface area of a solid half-cylinder has three parts:
- Two semicircular ends (one full circle): $\pi \times 6^2 = 36\pi$ cm^2.
- Half the curved surface area: $\frac{1}{2} \times 2\pi rh = \pi(6)(20) = 120\pi$ cm^2.
- Flat rectangular base (width $=$ diameter $= 12$ cm): $12 \times 20 = 240$ cm^2.
3. Add all parts together:
TSA $= 36\pi + 120\pi + 240 = 156\pi + 240 = 490.08845\cdots + 240 = 730.08845\ldots$ cm^2.
Correct to 3 significant figures: **730 cm^2**.

Extreme Challenge

1. Write expressions for Volume and Total Surface Area:
$V = \pi r^2 h$
TSA $= 2\pi r^2 + 2\pi rh$.
2. Equate them and divide through by πr (since $r > 0$):
$\pi r^2 h = 2\pi r^2 + 2\pi rh$
$rh = 2r + 2h$.
3. Substitute $h = 4r$:
$r(4r) = 2r + 2(4r)$
$4r^2 = 10r$
$4r^2 - 10r = 0 \implies 2r(2r - 5) = 0$.
Since $r > 0$, **r = 2.5** (or $\frac{5}{2}$).
4. Find h and calculate the exact volume:
$h = 4 \times 2.5 = 10$ cm.
$V = \pi(2.5)^2(10) = \pi(6.25)(10) =$ **62.5π cm^3** (or **$\frac{125}{2}\pi$ cm^3**).