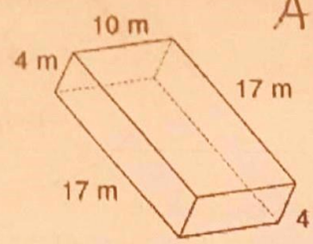
"B" is not base, it's the Area of the base!

VOLUME FORMULAS

For #1-20, Solve the YOUR TURN Problem that is modeled after the Example.

Example

① The formula for the volume of a rectangular prism is $V = Bh$. Find the volume of the prism below.



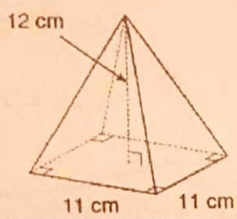
$A = lwh$

$(4)(10)(17)$

$680\,m^3$

② The formula for the volume of a pyramid is $V = \frac{1}{3}Bh$. Find the volume of the pyramid below.

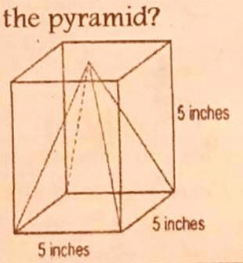
base is a square lw



$V = \frac{1}{3} \cdot 12 \cdot 11 \cdot 11$

$V = 484\,cm^3$

③ A square pyramid is packaged inside a box. The space inside the box around the pyramid is then filled with protective foam. About how many cubic inches of foam is needed to fill the space around the pyramid?



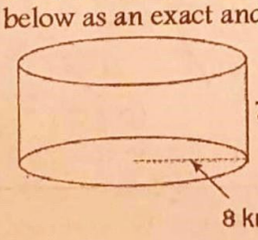
$5^3 - \left(\frac{1}{3} \cdot 5 \cdot 5^2\right)$

$\approx 83.33\,in^3$

④ Density is mass divided by volume. Find the density of an aluminum block with a mass of 35 grams and dimensions 2 cm by 7 cm by 1 cm.

$D = \frac{m}{V} = \frac{35\,grams}{2 \cdot 7 \cdot 1\,cm^3} = 2.5\,\frac{gram}{cm^3}$

⑤ The formula for the volume of a cylinder is $V = Bh = \pi r^2 h$. Find the volume of the cylinder below as an exact and estimated answer.



$V = \pi(8)^2(7)$

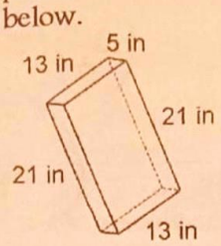
$448\pi\,km^3$

or

$1407.43\,km^3$

YOUR TURN

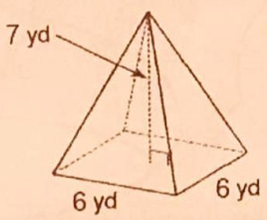
① The formula for the volume of a rectangular prism is $V = Bh$. Find the volume of the prism below.



$(21)(13)(5)$

$1365\,in^3$

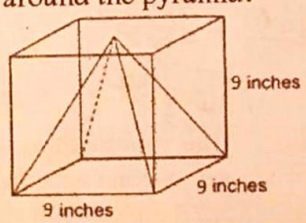
② The formula for the volume of a pyramid is $V = \frac{1}{3}Bh$. Find the volume of the pyramid below.



$V = \frac{1}{3} \cdot 7 \cdot 6 \cdot 6$

$84\,yd^3$

③ A square pyramid is packaged inside a box. The space inside the box around the pyramid is then filled with protective foam. About how many cubic inches of foam is needed to fill the space around the pyramid?



$9^3 - \left(\frac{1}{3} \cdot 9 \cdot 9^2\right)$

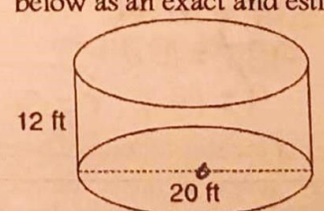
$486\,in^3$

④ Density is mass divided by volume. Find the density of an iron block with a mass of 441 grams and dimensions 7 cm by 4 cm by 2 cm.

$D = \frac{m}{V} = \frac{441\,grams}{7 \times 4 \times 2\,cm^3}$

$= 7.875\,grams/cm^3$

⑤ The formula for the volume of a cylinder is $V = Bh = \pi r^2 h$. Find the volume of the cylinder below as an exact and estimated answer.

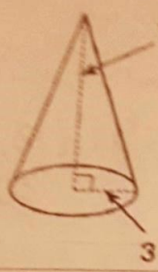


$V = \pi(10)^2(12$

$1200\pi\,ft$

$3769.91\,ft$

⑥ The formula for the volume of a cone is $V = \frac{1}{3}Bh = \frac{1}{3}\pi r^2 h$. Find the volume of the cone below as an exact and estimated answer.



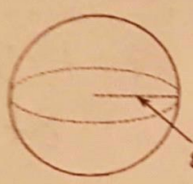
$V = \frac{1}{3} \cdot \pi \cdot r^2 \cdot h$

$(\frac{1}{3})(\pi)(3^2)(10)$

$30\pi m^3$

$94.24 m^3$

⑦ The formula for the volume of a sphere is $V = \frac{4}{3}\pi r^3$. Find the volume of the sphere below as an exact and estimated answer.



$V = \frac{4}{3} \cdot \pi \cdot 8^3$

$\frac{2048\pi}{3} in^3$ or $2144.66 in^3$

⑧ The formula for the volume of a pyramid is $V = \frac{1}{3}Bh$. A square pyramid with height 10 cm has a volume of 160/3 cm³. What should be the side length of the square pyramid?

$\frac{160}{3} = \frac{1}{3} s^2 \cdot 10$

$\frac{160}{3} = \frac{10}{3} s^2$

$\sqrt{16} = \sqrt{s^2}$ $s = 4$

⑨ The formula for the volume of a cone is $V = \frac{1}{3}Bh = \frac{1}{3}\pi r^2 h$. A cone with height 10 cm has a volume of $250\pi/3$ cm³. What should be the radius of the cone?

$\frac{250\pi}{3} = \frac{1}{3}\pi \cdot r^2 \cdot 10$

$\frac{250\pi}{3} = \frac{10\pi}{3} r^2$ $\sqrt{r^2} = \sqrt{25}$ $r = 5$

⑩ The formula for the volume of a cylinder is $V = Bh = \pi r^2 h$. A cylinder with height 10 cm has a volume of 90π cm³. What should be the radius of the cylinder?

$90\pi = \pi \cdot r^2 \cdot 10$

$90\pi = 10\pi r^2$

$9 = r^2$ $r = 3$

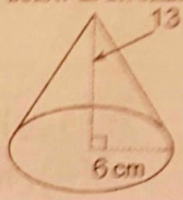
⑪ The formula for the volume of a sphere is $V = \frac{4}{3}\pi r^3$. A sphere has a volume of $32\pi/3$ cm³. What should be the radius of the sphere?

$\frac{32\pi}{3} = \frac{4}{3}\pi r^3$

$8 = r^3$

$r = 2$

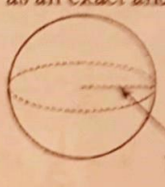
⑥ The formula for the volume of a cone is $V = \frac{1}{3}Bh = \frac{1}{3}\pi r^2 h$. Find the volume of the cone below as an exact and estimated answer.



$V = \frac{1}{3} \cdot \pi \cdot 6^2 \cdot 13$

$156\pi cm^3$ or $490.09 cm^3$

⑦ The formula for the volume of a sphere is $V = \frac{4}{3}\pi r^3$. Find the volume of the sphere below as an exact and estimated answer.



$V = \frac{4}{3} \cdot \pi \cdot 11^3$

$\frac{5324\pi}{3} mi^3$ $5575.38 mi^3$

⑧ The formula for the volume of a pyramid is $V = \frac{1}{3}Bh$. A square pyramid with height 20 cm has a volume of 1620/3 cm³. What should be the side length of the square pyramid?

$\frac{1620}{3} = \frac{1}{3} \cdot s^2 \cdot 20$

$\frac{1620}{3} = \frac{20}{3} s^2$

$\sqrt{s^2} = \sqrt{81}$ $s = 9$

⑨ The formula for the volume of a cone is $V = \frac{1}{3}Bh = \frac{1}{3}\pi r^2 h$. A cone with height 20 cm has a volume of $980\pi/3$ cm³. What should be the radius of the cone?

$\frac{980\pi}{3} = \frac{1}{3} \cdot \pi \cdot r^2 \cdot 20$

$\frac{980\pi}{3} = \frac{20\pi}{3} r^2$

$\sqrt{r^2} = \sqrt{49}$ $r = 7$

⑩ The formula for the volume of a cylinder is $V = Bh = \pi r^2 h$. A cylinder with height 20 cm has a volume of 1280π cm³. What should be the radius of the cylinder?

$1280\pi = \pi \cdot r^2 \cdot 20$

$1280\pi = 20\pi r^2$

$64 = r^2$ $r = 8$

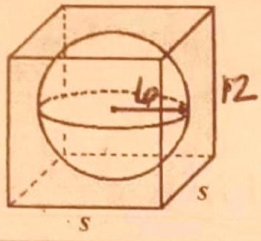
⑪ The formula for the volume of a sphere is $V = \frac{4}{3}\pi r^3$. A sphere has a volume of $500\pi/3$ cm³. What should be the radius of the sphere?

$\frac{500\pi}{3} = \frac{4}{3}\pi r^3$

$125 = r^3$

$r = 5$

⑫ A globe with a *diameter* of 12 cm is wrapped in a cube with the same dimensions as the sphere's diameter. Foam is to cover the sphere in the box to prevent it from being damaged. What should be the volume of the foam?



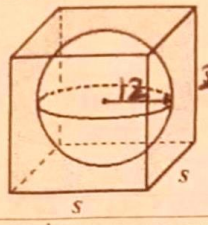
$V = s^3 - \frac{4}{3}\pi r^3$

$V = 12^3 - \frac{4}{3}\pi(6)^3$

$1728 - 288\pi$

$= 823.22\,cm^3$

⑫ A globe with a *diameter* of 24 cm is wrapped in a cube with the same dimensions as the sphere's diameter. Foam is to cover the sphere in the box to prevent it from being damaged. What should be the volume of the foam?



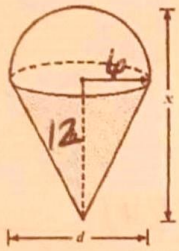
$V = s^3 - \frac{4}{3}\pi r^3$

$24^3 - \frac{4}{3}\cdot\pi\cdot 12^3$

$13824 - 2304\pi$

$= 6585.77\,cm^3$

⑬ An ice cream cone shown has a ~~*diameter*~~ of 12 cm with a total height of 18 cm. What should be the volume of the ice cream cone?



$V = \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$

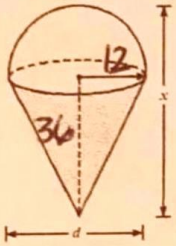
$\frac{2}{3}\cdot\pi\cdot 6^3 + \frac{1}{3}\cdot\pi\cdot 6^2\cdot 12$

$144\pi + 144\pi$

$288\pi\,cm^3$

$904.78\,cm^3$

⑬ An ice cream cone shown has a ~~*diameter*~~ of 24 cm with a total height of 36 cm. What should be the volume of the ice cream cone?



$V = \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$

$\frac{2}{3}\cdot\pi\cdot 12^3 + \frac{1}{3}\pi\cdot 12^2\cdot 36$

$1152\pi + 1728\pi$

$2880\pi\,cm^3$

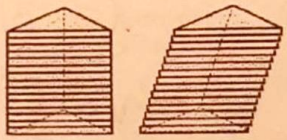
$9047.79\,cm^3$

⑭ Cavalieri's principle claims that a stack of coins have the same volume no matter how the coins are stacked. Write what is true about the cylinders below.

Bonaventura Cavalieri of Milan, Italy 1598-1647

They will have the same volume because each coin has the same area regardless how you stack

⑭ Two prisms are constructed using solid metal triangles. Each prism has the same height, but one is slanted as shown. Write what is true about the prisms below.



They will have the same volume because each prism has the same area.

⑮ Given is a stack of pennies, each with a thickness of 1 millimeter. The diameter of a penny is 19.05 mm. What should be volume of the stack?

$r = 19.05/2 = 9.525$

$A = \pi r^2 \cdot 9$

$(\pi)(9.525)^2 \cdot 9 = 2565.18\,mm^3$

⑮ Given is a stack of dimes, each with a thickness of 1 millimeter. The diameter of a dime is 21.21 mm. What should be volume of the stack?

$\frac{21.21}{2} = 10.605$

$A = \pi(10.605)^2$

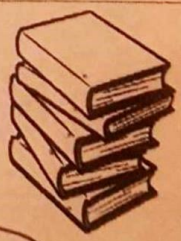
$2473.26\,mm^3$

⑯ Given is a stack of books, each 9 by 12 by 1 inch. What should be volume of the stack?

$(9)(12)(1) = 108\,in^3$

$(108)7 = 756\,in^3$

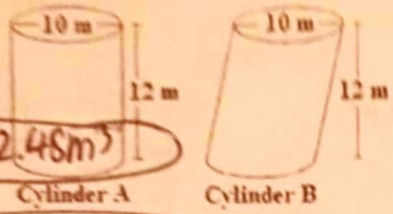
⑯ Given is a ~~stack of books~~, each 7 by 12 by 1 inch. What should be volume of the stack?



$(7)(12)(1) = 84\,in^3$

$84(5) = 420\,in^3$

(17) Cylinders A and B are shown below. Based on Cavalieri's Principle, what should be the volume of each cylinder?



A: $V = \pi r^2 h$

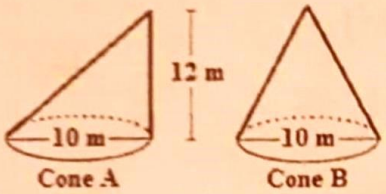
$V = \pi \cdot 5^2 \cdot 12$

$300\pi\ m^3 = 942.48 m^3$

B: $V = \pi \cdot 5^2 \cdot 12$

$300\pi\ m^3 = 942.48\ m^3$

(18) Cones A and B are shown below. Based on Cavalieri's Principle, what should be the volume of each cone?



$V = \frac{1}{3} \cdot \pi r^2 h$

A: $V = \frac{1}{3} \cdot \pi \cdot 5^2 \cdot 12$

$V = 100\pi\ m^3$

$= 314.16 m^3$

B: $V = \frac{1}{3} \cdot \pi \cdot 5^2 \cdot 12$

$V = 100\pi$

$= 314.16 m^3$

(17) Cylinders A and B are shown below. Based on Cavalieri's Principle, what should be the volume of each cylinder?

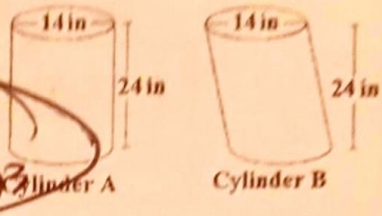
$V = \pi r^2 h$

$= \pi \cdot 7^2 \cdot 24$

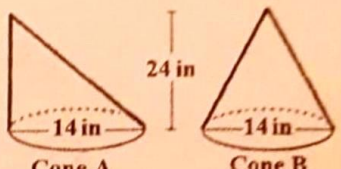
1176π

$=$

$3694.51\ in^3$



(18) Cones A and B are shown below. Based on Cavalieri's Principle, what should be the volume of each cone?



$V = \frac{1}{3} \cdot \pi r^2 h$

$\left(\frac{1}{3}\right)(\pi)(7)^2(24)$

$392\pi = 1231.50\ in^3$