Name ____ Date ____________________

1.

a. We define x as a year between 2008 and 2013, and y as the total number of smartphones sold that year, in millions. The table shows values of x, and corresponding y values.

Year (x)	2008	2009	2010	2011	2012	2013
Number of smartphones in millions (y)	3.7	17.3	42.4	90	125	153.2

i. How many smartphones were sold in 2009?

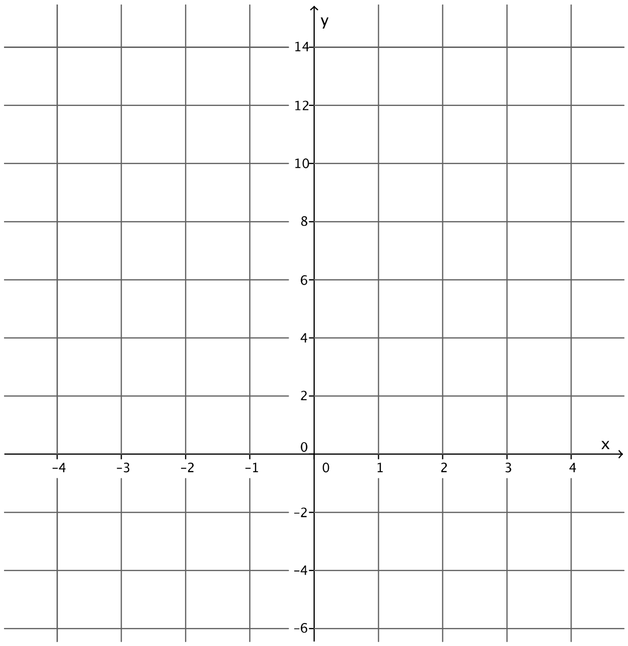
ii. In which year were 90 million smartphones sold?

iii. Is y a function of x? Explain why or why not.

b. Randy began completing the table below to represent a particular linear function. Write an equation to represent the function he used, and complete the table for him.

Input (x)	-3	-1	0	$\frac{1}{2}$	1	2	3
Output (y)	-5		4				13

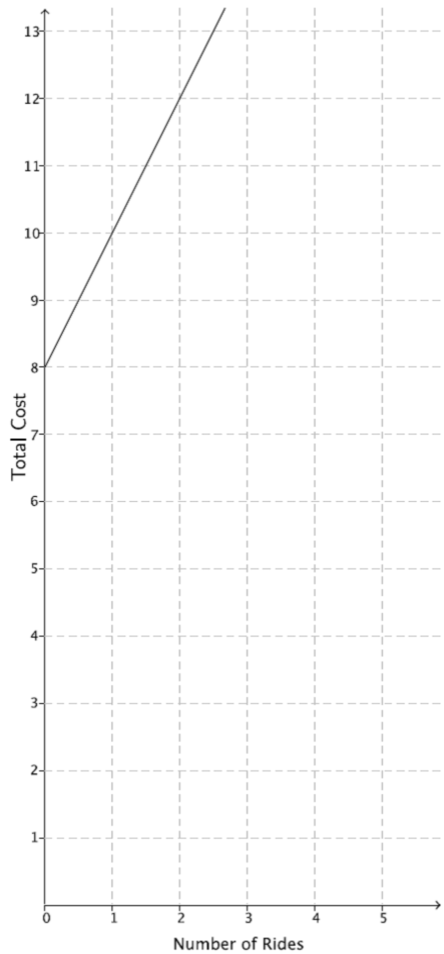
c. Create the graph of the function in part (b).



d. At NYU in 2013, the cost of the weekly meal plan options could be described as a function of the number of meals. Is the cost of the meal plan a linear or non-linear function? Explain.

8 meals: \$125/week
10 meals: \$135/week
12 meals: \$155/week
21 meals: \$220/week

2. The cost to enter and go on rides at a local water park, Wally's Water World, is shown in the graph below.



A new water park just opened named Tony's Tidal Takeover. You haven't heard anything specific about how much it costs to go to this park, but some of your friends have told you what they spent. The information is organized in the table below.

# of rides	0	2	4	6
$ spent	12	13.50	15	16.50

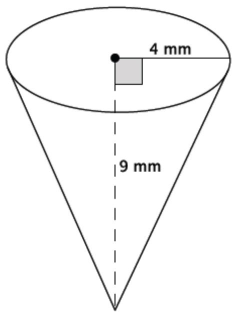
Each park charges a different admission fee and a different fee per ride, but the cost of each ride remains the same.

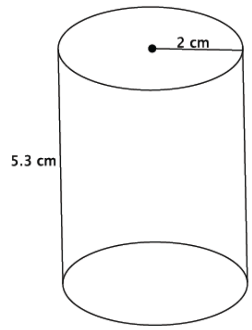
a. If you only have $14 to spend, which park would you attend (assume the rides are the same quality)? Explain.

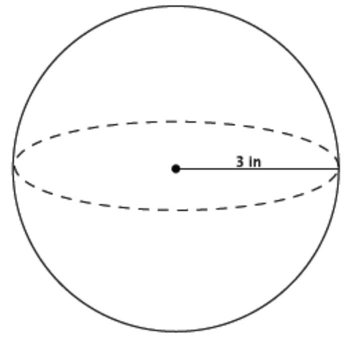
b. Another water park, Splash, opens and they charge an admission fee of $30 with no additional fee for rides. At what number of rides does it become more expensive to go to Wally's Water Park than Splash? At what number of rides does it become more expensive to go to Tony's Tidal Takeover than Splash?

c. For all three water parks, the cost is a function of the number of rides. Compare the functions for all three water parks in terms of their rate of change. Describe the impact it has on the total cost of attending each park.

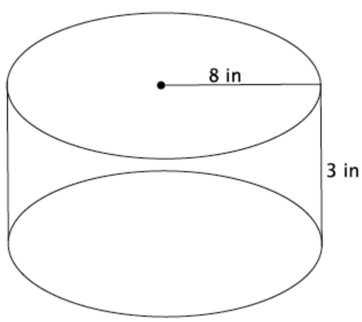
3. For each part below, leave your answers in terms of π.
   a. Determine the volume for each three-dimensional figure shown below.



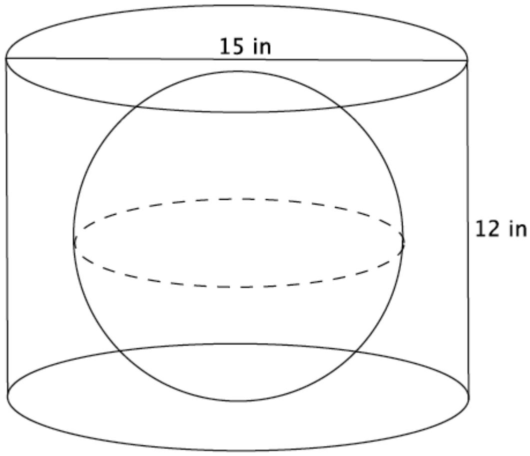




   b. You want to fill the cylinder shown below with water. All you have is a container shaped like a cone with a radius of 3 inches and a height of 5 inches; you can use this cone-shaped container to take water from a faucet and fill the cylinder. How many cones will it take to fill the cylinder?



c. You have a cylinder with a diameter of 15 inches and height of 12 inches. What is the volume of the largest sphere that will fit inside of it?



A Progression Toward Mastery					
Assessment Task Item		**STEP 1** Missing or incorrect answer and little evidence of reasoning or application of mathematics to solve the problem.	**STEP 2** Missing or incorrect answer but evidence of some reasoning or application of mathematics to solve the problem.	**STEP 3** A correct answer with some evidence of reasoning or application of mathematics to solve the problem, <u>or</u> an incorrect answer with substantial evidence of solid reasoning or application of mathematics to solve the problem.	**STEP 4** A correct answer supported by substantial evidence of solid reasoning or application of mathematics to solve the problem.
1	**a** **8.F.A.1**	Student makes little or no attempt to solve the problem.	Student answers at least one of the three questions correctly as 17.3 million, 2011, or yes. No explanation is provided as to why y is a function of x.	Student answers all three questions correctly as 17.3 million, 2011, and yes. Student provides an explanation as to why y is a function of x. Student may not have used vocabulary related to functions.	Student answers all three questions correctly as 17.3 million, 2011, and yes. Student provides a *compelling* explanation as to why y is a function of x and uses appropriate vocabulary related to functions (e.g., assignment, *input,* and *output*).
	b **8.F.A.1**	Student makes little or no attempt to solve the problem. No function or equation is written by the student. The outputs may or may not be calculated correctly.	The equation to describe the function is not written correctly. The outputs may be correct for the function described by the student. The outputs may or may not be calculated correctly. Student may have made calculation errors. Two or more of the outputs are calculated correctly.	The equation to describe the function is written correctly. Three or more of outputs are calculated correctly. Student may have made calculation errors.	The equation to describe the function is written correctly as $y = 3x + 4$. All four of the outputs are calculated correctly as when $x = -1$, $y = 1$; when $x = \frac{1}{2}$, $y = \frac{11}{2}$; when $x = 1$, $y = 7$; and when $x = 2$, $y = 10$.

	c **8.F.A.1**	Student makes little or no attempt to solve the problem. Student may have graphed some or all of the input/outputs given.	The input/outputs do not appear to be linear. The student graphs the input/outputs incorrectly (e.g., $(4,0)$ instead of $(0,4)$).	The input/outputs appear to be linear. The student may or may not have graphed the input/outputs correctly (e.g., $(4,0)$ instead of $(0,4)$).	Student graphs the input/outputs correctly. The input/outputs appear to be linear.
	d **8.F.A.3**	Student does not attempt the problem or left the problem blank. Student may or may not have made a choice. No explanation is given.	Student determines the meal plan is linear or non-linear. No explanation is given or the explanation does not include any mathematical reasoning.	Student determines correctly the meal plan is non-linear. Explanation includes some mathematical reasoning. Explanation may or may include reference to the graph.	Student determines correctly that the meal plan is non-linear. Explanation includes substantial mathematical reasoning. Graph may or may not be used as part of the reasoning.
2	**a** **8.F.A.2**	Student does not attempt the problem or leaves the problem blank. Student may or may not have made a choice. No explanation is given.	Student identifies either choice. Significant calculation errors are made. Little or no explanation was given.	Student identifies either choice. Student may have made calculation errors. Explanation may or may not have included the calculation errors.	Student identifies Wally's Water World would be the better choice. Student references that for $\$14$ they can ride three rides at Wally's but they can only ride two rides at Tony's Tidal Takeover.
	b **8.F.A.2**	Student does not attempt the problem or leaves the problem blank. No explanation is given.	Student identifies the number of rides at both parks incorrectly. Student may or may not identify functions to solve the problem. For example, student uses the table or counting method. Some attempt is made to find the function for one or both of the parks. The functions used are incorrect.	Student identifies the number of rides at one of the parks correctly. Some attempt is made to find the function for one or both of the parks. Student may or may not identify functions to solve the problem. For example, student uses the table or counting method. One function used is correct.	Student identifies that they could ride 24 rides for $\$30$ at Wally's. Student identifies that they could ride 11 rides for $\$30$ at Tony's. Student identifies functions to solve the problem (e.g., if x is the number of rides, $w = 2x + 8$ for the cost of Wally's and, $t = 0.75x + 12$ for the cost of Tony's).
	c **8.F.A.2**	Student does not attempt the problem or leaves the problem blank.	Student may have identified the rate of change for each park, but does so incorrectly. Student may not have compared the rate of change for each park. Student may have described the impact of the rate of change on total cost for one or two	Student correctly identifies the rate of change for each park. Student may or may not have compared the rate of change for each park. Student may have described the impact of the rate of change on total cost for all parks, but makes minor	Student correctly identifies the rate of change for each park, Wally's is 2, Tony's is 0.75, and Splash is 0. Student compares the rate of change for each park and identifies which park had the greatest rate of change (or least rate of change) as part of

			of the parks, but draws incorrect conclusions.	mistakes in the description.	the comparison. Student describes the impact of the rate of change on the total cost for each park.
3	**a** **8.G.C.9**	Student finds 0 to 1 of the volumes correctly. Student may or may not have included correct units. Student may have omitted π from one or more of the volumes (i.e., the volume of the cone is 48). Student does not attempt the problem or leaves it blank.	Student finds 2 out of 3 volumes correctly. Student may or may not have included correct units. Student may have omitted π from one or more of the volumes (i.e., the volume of the cone is 48).	Student finds the volumes of all three figures correctly. Student does not include the correct units. Student may have omitted π from one or more of the volumes (i.e., the volume of the cone is 48).	Student finds the volumes of all three figures correctly, that is the volume of the cone is 48π mm^3, the volume of the cylinder is 21.2π cm^3 and the volume of the sphere is 36π in^3. Student includes the correct units.
	b **8.G.C.9**	Student does not attempt the problem or leaves the problem blank.	Student does not calculate the number of cones correctly. Student makes significant calculation errors. Student may have used the wrong formula for volume of the cylinder or the cone. Student may not have answered in a complete sentence.	Student may have calculated the number of cones correctly, but does not calculate the volume of the cylinder or cone correctly (e.g., volume of the cone is 192, omitting the π). Student calculates the volume of a cone correctly at 15π in^3 or the volume of the cylinder correctly at 192π in^3, but not both. Student may have used incorrect units. Student may have made minor calculation errors. Student may not answer in a complete sentence.	Student answers correctly that it will take 12.8 cones to fill the cylinder. Student calculates the volume of a cone correctly at 15π in^3 and the volume of the cylinder correctly at 192π in^3. Student answers in a complete sentence.
	c **8.G.C.9**	Student does not attempt the problem or leaves the problem blank.	Student does not calculate the volume correctly. Student may have used the diameter instead of the radius for calculations. Student may have made calculation errors. Student may or may not have omitted π. Student may or may not have included the units.	Student calculates the volume correctly, but does not include the units or includes incorrect units (e.g., cm^2). Student uses the radius of 6 to calculate the volume. Student may have calculated the volume as 288 (π is omitted).	Student calculates the correct volume of 288π cm^3. Student uses the radius of 6 to calculate the volume. Student includes correct units.

Name ______________________________ Date ______________

1.

a. We define x as a year between 2008 and 2013 and y as the total number of smartphones sold that year, in millions. The table shows values of x and corresponding y values.

Year (x)	2008	2009	2010	2011	2012	2013
Number of smartphones in millions (y)	3.7	17.3	42.4	90	125	153.2

How many smartphones were sold in 2009?

17.3 MILLION SMARTPHONES WERE SOLD IN 2009.

In which year were 90 million smartphones sold?

90 MILLION SMART PHONES WERE SOLD IN 2011.

Is y a function of x? Explain why or why not.

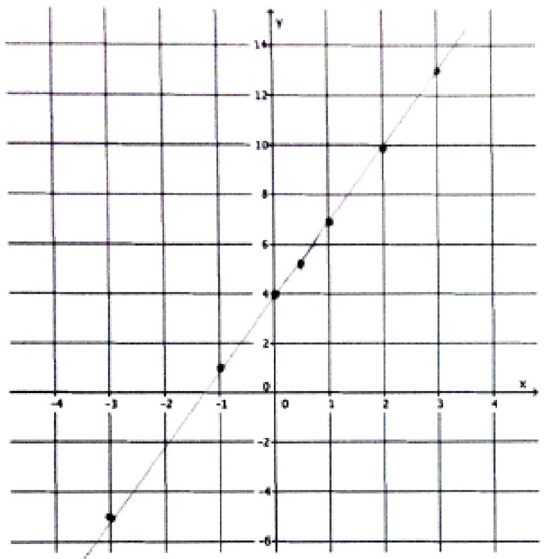
YES IT IS A FUNCTION BECAUSE FOR EACH INPUT THERE IS EXACTLY ONE OUTPUT. SPECIFICALLY, ONLY ONE NUMBER WILL BE ASSIGNED TO REPRESENT THE NUMBER OF SMART PHONES SOLD IN THE GIVEN YEAR.

b. Randy began completing the table below to represent a particular linear function. Write an equation to represent the function he was using and compete the table for him.

Input (x)	-3	-1	0	$\frac{1}{2}$	1	2	3
Output (y)	-5	1	4	$\frac{11}{2}$	7	10	13

$y = 3x + 4$

c. Create the graph of the function in part (b).

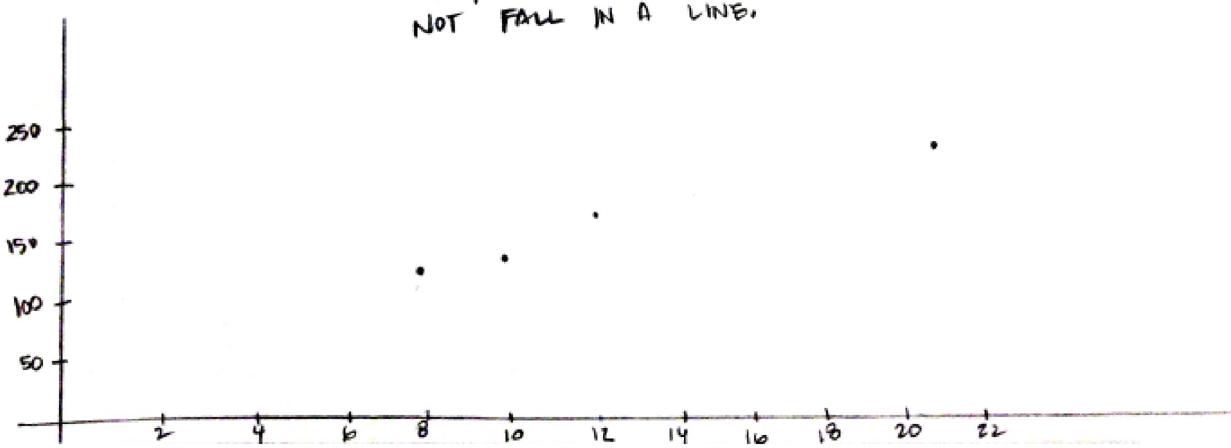


d. At NYU in 2013, the cost of the weekly meal plan options could be described as a function of the number of meals. Is the cost of the meal plan a linear or non-linear function? Explain.

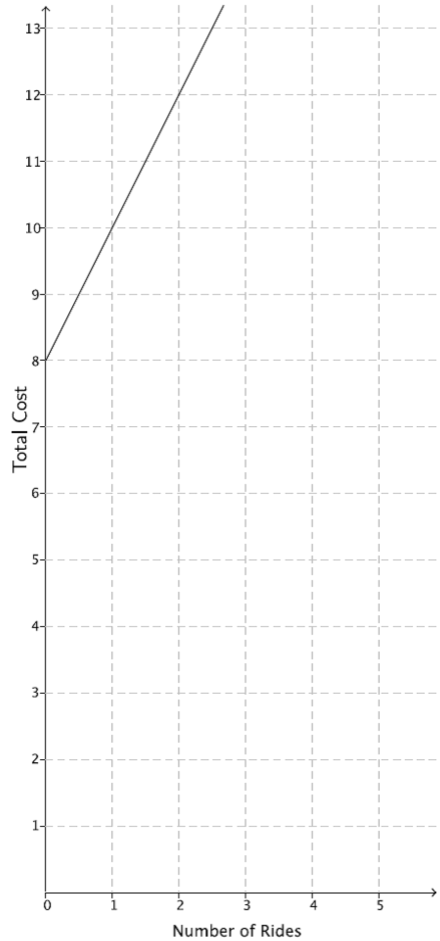
8 meals: \$125/week
10 meals: \$135/week
12 meals: \$155/week
21 meals: \$220/week

$\frac{125}{8} = 15.625$ $\quad \frac{135}{10} = 13.5$ $\quad \frac{155}{12} = 12.917$ $\quad \frac{220}{21} = 10.476$

THE COST OF THE MEAL PLAN IS A NON-LINEAR FUNCTION. THE COST OF EACH MEAL IS DIFFERENT BASED ON THE PLAN. FOR EXAMPLE, ONE PLAN CHARGES ABOUT \$16 PER MEAL, ANOTHER PLAN CHARGES JUST \$10. ALSO, WHEN THE DATA IS GRAPHED, THE POINTS DO NOT FALL IN A LINE.



2. The cost to enter and go on rides at a local water park, Wally's Water World, is shown in the graph below.



LET x REPRESENT THE # OF RIDES

LET W REPRESENT THE TOTAL COST AT WALLY'S WATER WORLD

$W = 2x + 8$

A new water park just opened named Tony's Tidal Takeover. You haven't heard anything specific about how much it costs to go to this park but some of your friends have told you what they spent. The information is organized in the table below; your friends told you they paid an admission fee to get in and then the same amount for each ride.

# of rides	0	2	4	6
$ spent	12	13.50	15	16.50

1.50 1.50

LET x REPRESENT THE # OF RIDES

LET T REPRESENT TOTAL COST AT TONY'S TIDAL TAKEOVER

$T = 0.75x + 12$

a. If you only have $14 to spend, which park would you attend (assume the rides are the same quality)? Explain.

WALLY'S

$W = 2x + 8$

$14 = 2x + 8$

$6 = 2x$

$3 = x$

TONY'S

$T = 0.75x + 12$

$14 = 0.75x + 12$

$2 = 0.75x$

$2.67 \approx x$

AT WALLY'S, YOU CAN GO ON 3 RIDES WITH $14, AT TONY'S JUST 2 RIDES. THEREFORE I WOULD GO TO WALLY'S BECAUSE YOU CAN GO ON MORE RIDES.

b. Another water park, Splash, opens and they charge an admission fee of $30 with no additional fee for rides. At what number of rides does it become more expensive to go to Wally's Water Park than Splash? At what number of rides does it become more expensive to go to Tony's Tidal Takeover than Splash?

LET S REPRESENT TOTAL COST AT SPLASH, $S = 30$

WALLY'S	TONY'S
$30 = 2x + 8$	$30 = 0.75x + 12$
$22 = 2x$	$18 = 0.75x$
$11 = x$	$24 = x$

AT WALLY'S YOU CAN GO ON 11 RIDES WITH $30. THE 12th RIDE MAKES WALLYS MORE EXPENSIVE THAN SPLASH.

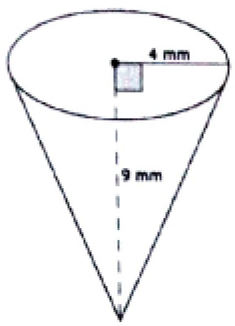
AT TONYS YOU CAN GO ON 24 RIDES WITH $30. THE 25th RIDES MAKES TONY'S MORE EXPENSIVE THAN SPLASH.

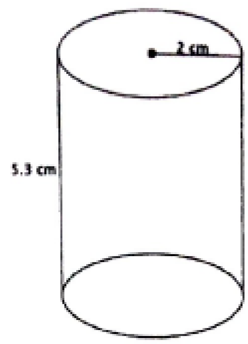
c. For all three water parks, the cost is a function of the number of rides. Compare the functions for all three water parks in terms of their rate of change. Describe the impact it has on the total cost of attending each park.

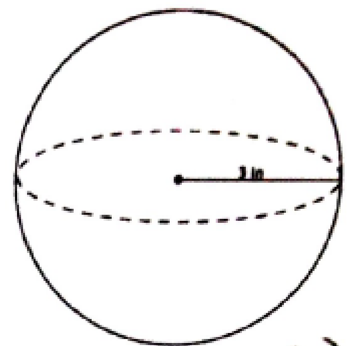
WALLY'S RATE OF CHANGE IS 2, $2 PER RIDE.
TONY'S RATE OF CHANGE IS 0.75, $0.75 PER RIDE.
SPLASH'S RATE OF CHANGE IS 0, $0 EXTRA PER RIDE.
WALLYS HAS THE GREATEST RATE OF CHANGE. THAT MEANS THAT THE TOTAL COST AT WALLYS WILL INCREASE THE FASTEST AS WE GO ON MORE RIDES. AT TONY'S, THE RATE OF CHANGE IS JUST 0.75 SO THE TOTAL COST INCREASES WITH THE NUMBER OF RIDES WE GO ON, BUT NOT AS QUICKLY AS WALLY'S. SPLASH HAS A RATE OF CHANGE OF ZERO. THE NUMBER OF RIDES WE GO ON DOES NOT IMPACT THE TOTAL COST AT ALL.

3.

a. Determine the volume for each of the three-dimensional figures shown below.





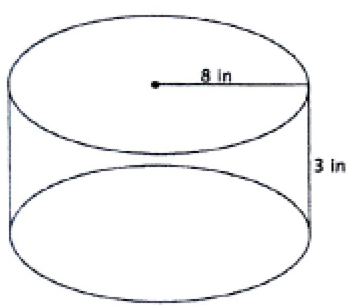


$V = \frac{1}{3}\pi(16)(9)$
$= (16)(3)(\pi)$
$= 48\pi \text{ mm}^3$

$V = \pi(4)(5.3)$
$= \pi(21.2)$
$= 21.2\pi \text{ cm}^3$

$V = \frac{4}{3}\pi(3^3)$
$= 4(9)\pi$
$= 36\pi \text{ in}^3$

b. You want to fill the cylinder shown below with water. All you have is a container shaped like a cone with a radius of 3 inches and a height of 5 inches; you can use this cone-shaped container to take water from a faucet and fill the cylinder. How many cones will it take to fill the cylinder?



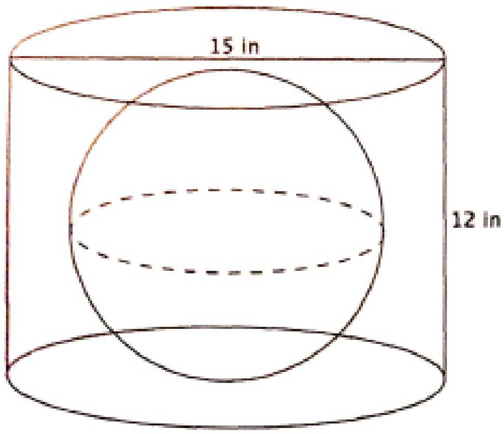
VOLUME OF CYLINDER $= \pi(64)(3)$
$= 192\pi \text{ in}^3$

VOLUME OF CONE $= \frac{1}{3}\pi(9)(5)$
$= \frac{45}{3}\pi$
$= 15\pi \text{ in}^3$

$\frac{192\pi}{15\pi} = \frac{192}{15} = 12.8$

IT TAKES 12.8 CONES OF THE GIVEN SIZE TO FILL THE CYLINDER.

c. You have a cylinder with a diameter of 15 cm and height of 12 cm. What is the volume of the largest sphere that will fit inside of it?



THE CYLINDER HAS RADIUS OF 7.5 cm, BUT THE HEIGHT IS JUST 12 cm. THAT MEANS THE MAXIMUM RADIUS FOR THE SPHERE IS 6 cm. ANYTHING LARGER WOULD NOT FIT IN THE CYLINDER. THEN THE VOLUME OF THE LARGEST SPHERE THAT WILL FIT IN THE CYLINDER IS

$$V = \frac{4}{3}\pi(6^3)$$
$$= \frac{4}{3}\pi(216)$$
$$= 288\pi \text{ cm}^3.$$