Lesson 9-5

Objective - To describe the effect of changing measures in different dimensions.

Dimensional Measures

1-D Measures	2-D Measures	3-D Measures
(units)	(un^2)	(un^3)
Height	Area	Volume
Length	Base Area	
Width	Surface Area	
Depth		
Perimeter		
Circumference		

		1-D	2-D
Original Figure	2, 3	P = 10 un.	A = 6 un^2
2x sides	4, 6	P = 20 un. (2×)	A = 24 un^2 (4×)
3x sides	6, 9	P = 30 un. (3×)	A = 54 un^2 (9×)
5x sides	10, 15	P = 50 un. (5×)	A = 150 un^2 (25×)

If the dimensions of a 2D figure increase by scale factor k, then the area increases by k^2.

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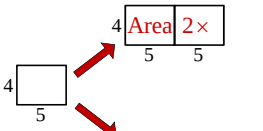
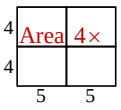
Slot Machine

7 7 7	$100
7 7 2x	$200
7 2x 2x	$400
2x 2x 2x	$800

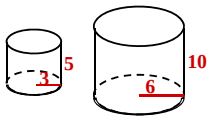
Length Doubles

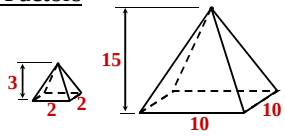


Length and Width Doubles



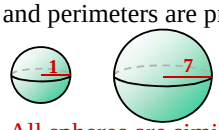
Scaling Factors



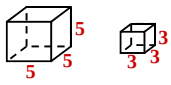


Scale Factor, k = 2 Scale Factor, k = 5

Similar Solids - Solids that have the same shape but not necessarily the same size. Bases, edges, and perimeters are proportional.

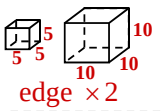


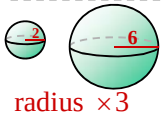
All spheres are similar
k = 7

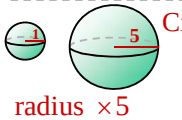


All cubes are similar
k = 0.6

Solid	1-D Measures	2-D Measures	3-D Measures
edge ×2	perimeter of base ×2	surface area $\times 2^2$	volume $\times 2^3$
	k = 2	k = 4	k = 8
radius ×3	Diameter ×3	surface area $\times 3^2$	volume $\times 3^3$
	k = 3	k = 9	k = 27
radius ×5	Circumference ×5	surface area $\times 5^2$	volume $\times 5^3$
	k = 5	k = 25	k = 125







If the length of a solid increases by scale factor k, then the surface area increases by k^2, and the volume by k^3.

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Lesson 9-5

Describe the impact on the following if the given dimension is increased as follows.

1) The radius of a sphere is increased 4 times.

a) diameter: diameter $\times 4$

b) surface area: surface area $\times 4^2$ or $\times 16$

c) volume: volume $\times 4^3$ or $\times 64$

d) circumference: circumference $\times 4$

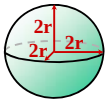
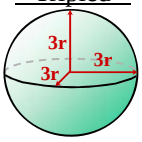
2) The length, width, and height of a prism are tripled.

a) base perimeter: base perimeter $\times 3$

b) surface area: surface area $\times 3^2$ or $\times 9$

c) volume: volume $\times 3^3$ or $\times 27$

How does the volume of a sphere change when the radius is doubled or tripled?

Original Sphere	Radius Doubled	Radius Tripled
		
$V = \frac{4}{3}\pi \bullet r^3$	$V = \frac{4}{3}\pi \bullet (2r)^3$	$V = \frac{4}{3}\pi \bullet (3r)^3$
	$V = \frac{4}{3}\pi \bullet 8r^3$	$V = \frac{4}{3}\pi \bullet 27r^3$
	8 times the volume ($2^3 = 8$)	27 times the volume ($3^3 = 27$)

A rectangular prism has a volume of 200 cm^3. If the length, width, and height are all decreased by a scale factor of $\frac{1}{4}$, what will the volume of the new prism be?

Scale factor: $k = \frac{1}{4}$

Effect on Volume: $k^3 = \left(\frac{1}{4}\right)^3 = \frac{1}{64}$

Original: 200 cm^3 → New: $\frac{1}{64} \bullet 200\ cm^3 = \frac{200}{64}\ cm^3$

$= 3.125\ cm^3$

A sphere has a surface area of 40 m^2. What is the surface area of a sphere that is larger by a scale factor of 3?

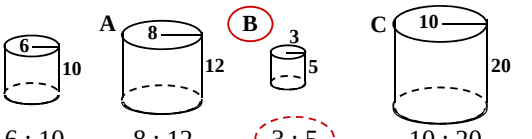
Scale factor: $k = 3$

Effect on Surface Area: $k^2 = (3)^2 = 9$

Original: 40 m^2 → New: $9 \bullet 40\ m^2 = 360\ m^2$

Match the given solid with its similar solid.

1)



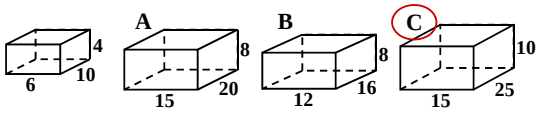
6 : 10
3 : 5

8 : 12
2 : 3

3 : 5

10 : 20
1 : 2

2)



4 : 6 : 10
2 : 3 : 5

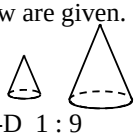
8 : 15 : 20

8 : 12 : 16
2 : 3 : 4

10 : 15 : 25
2 : 3 : 5

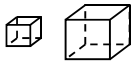
The ratios of the surface areas for the similar solids below are given. Find the ratio of their volumes.

1)



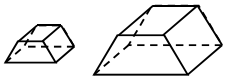
2-D 1 : 9
1-D 1 : 3
3-D 1 : 27

2)



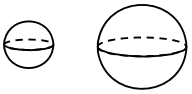
2-D 9 : 25
1-D 3 : 5
3-D 27 : 125

3)



2-D 4 : 9
1-D 2 : 3
3-D 8 : 27

4)



2-D 16 : 49
1-D 4 : 7
3-D 64 : 343