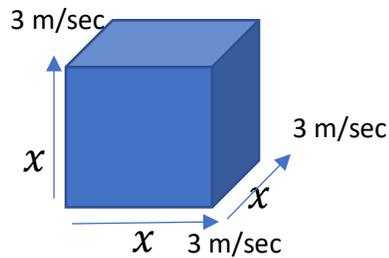


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Problem Description:

A cube (sides of equal length) is expanding outwards in all directions at a constant rate of 3 centimeters per second. Because the cube is expanding, the surface area of the cube is increasing as well. The goal is to find the speed at which the surface area is changing the moment when the edge of the cube is 10 centimeters long.

Picture:



Question your problem will answer:

How fast is the surface area changing when the cube has a side length of 10 cm long.

Formula's used in your problem (area, volume, etc.):

$$S = 6x^2$$

This is the formula for surface area because there are six sides of this cube and each side has an area of x^2 .

Variables & Constants:

Descriptors	Variables/Symbols	Values (if known)	Units
Surface Area	S	600 (see below)	cm^2
Change in Surface area with respect to time	$\frac{dS}{dt}$	Answer below	$\frac{cm^2}{sec}$
Edge length	x	10	cm
Speed at which edge length is changing	$\frac{dx}{dt}$	3	$\frac{cm}{sec}$

Problem Workspace:

Surface area when side length is 10 cm: $S(10) = 6(10)^2 = 600$

Implicitly differentiating the surface area formula:

$$\frac{d}{dt}[S = 6x^2]$$

$$\frac{d}{dt}[S] = \frac{d}{dt}[6x^2]$$

Used the chain rule when differentiating S and x since both change with respect to time.

$$\frac{dS}{dt} = 6 \cdot 2x \cdot \frac{dx}{dt}$$

Then, I substituted values that I know from the problem above.

$$\frac{dS}{dt} = 12 (10) \cdot 3$$

$$\frac{dS}{dt} = 360$$

The answer to the question being asked above (in context):

The surface area of the cube is changing at a rate of 360cm^2 every second at the exact moment when the cube has an edge length of 10 cm.

Summary paragraph of the problem and answer in context:

An expanding cube is growing outwards by 3cm every second. When this happens, the volume of the cube changes and the surface area of the cube also changes. This question was investigating the surface area of the cube at the moment when the edge length was 10cm long. When a cube has a side length of 10cm, the total surface area is 600cm^2 , but it doesn't stay that way for long because the cube is expanding. Using the surface area formula, I implicitly differentiated to find $\frac{dS}{dt}$ which is the speed at which the cube is expanding. Using the information given in the problem, I was able to substitute known values to determine that the surface area of this cube was increasing at a rate of 360cm^2 every second at the exact moment when the cube has an edge length of 10 cm.

Attach a self-evaluated rubric for BOTH of your problems (meaning you will have one rubric for the two problems you submit. You should edit your project if it does not meet all of the criteria.