Calculus 7.1 Key Points

Related Rates:

There are many, many different types of related rates problems (just like with optimization!), which you will often see in real-world situations.

As a general rule:
1. Identify the function for the relationship between the quantities that are changing
2. Use implicit differentiation to create a rate equation between the appropriate quantities
3. Substitute the necessary values to find the desired rate value
4. ANSWER THE QUESTION. Make sure you go back and find the answer to the original question and see if your solution makes sense based on the context of the problem.

List of Formulas:

3d shapes:

- Cylinder(Volume): $\pi r^2 h$
- Cylinder(Surface Area): $2\pi r^2 + 2\pi rh$
- Right Circular Cone(Volume): $\frac{1}{3}\pi r^2 h$
- Right Circular Cone(Surface Area): $\pi r^2 + \pi r\sqrt{r^2 + h^2}$
- Right Rectangular Pyramid(Volume): $\frac{1}{3}lwh$
- Right Rectangular Pyramid(Surface Area):
  $$lw + l\sqrt{h^2 + (\tfrac{w}{2})^2} + w\sqrt{h^2 + (\tfrac{l}{2})^2}$$
- Rectangular Prism(Volume): lwh
- Rectangular Prism(Surface Area): $2lw + 2lh + 2wh$
- Sphere(Volume): $\frac{4}{3}\pi r^3$
- Sphere(Surface Area): $4\pi r^2$

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2d shapes:
- Circle(Area): πr^2
- Circle(Circumference): πr^2
- Rectangle(Area): lw
- Rectangle(Perimeter): $2l + 2w$
- Triangle(Area): $\frac{1}{2}bh$

Trigonometry:
- $sin(\theta) = \frac{opposite}{hypotenuse}$
- $cos(\theta) = \frac{adjacent}{hypotenuse}$
- $tan(\theta) = \frac{opposite}{adjacent}$

Other
- Distance, Rate, and Time: $d = rt$
- Pythagorean Theorem: $a^2 + b^2 = c^2$
- Similar Triangles(Side Lengths): $AB/AD = AC/AE$