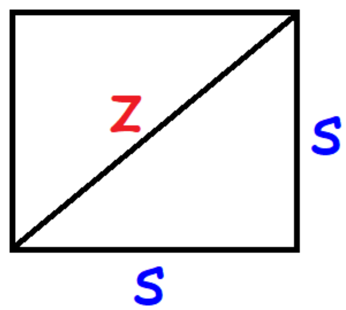
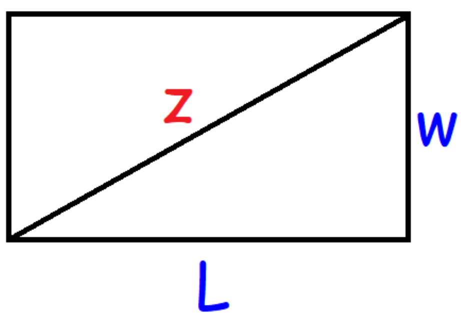
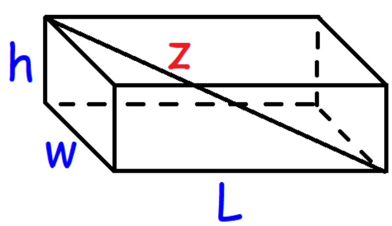
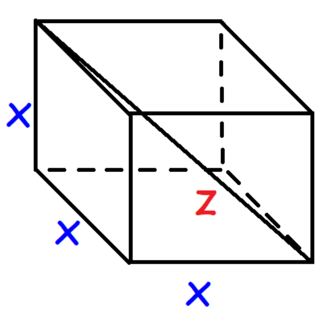
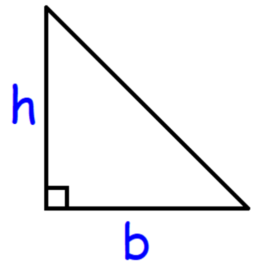
Related Rates – Formula Sheet:

The Square: 	**Area:** $A = s^2$ $\frac{dA}{dt} = 2s\frac{ds}{dt}$ **Perimeter:** $P = 4s$ **Diagonal Length:** $z^2 = 2s^2$
The Rectangle: 	**Area:** $A = lw$ **Perimeter:** $P = 2l + 2w$ **Diagonal Length:** $z^2 = l^2 + w^2$ $2z\frac{dz}{dt} = 2l\frac{dl}{dt} + 2w\frac{dw}{dt}$
The Rectangular Prism: 	**Volume:** $V = lwh$ **Surface Area:** $SA = 2lw + 2lh + 2wh$ **Diagonal Length:** $z^2 = l^2 + w^2 + h^2$
The Cube: 	**Volume:** $V = x^3$ $\frac{dV}{dt} = 3x^2\frac{dx}{dt}$ **Surface Area:** $SA = 6x^2$ **Diagonal Length:** $z^2 = 3x^2$

The Right Triangle:

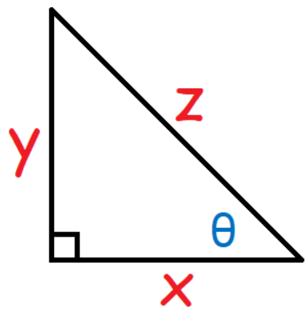


Area:

$$Area = \frac{1}{2} bh$$

$$\frac{dA}{dt} = \frac{1}{2}\left(b\frac{dh}{dt} + h\frac{db}{dt}\right)$$

The Pythagorean Theorem:



Side Lengths:

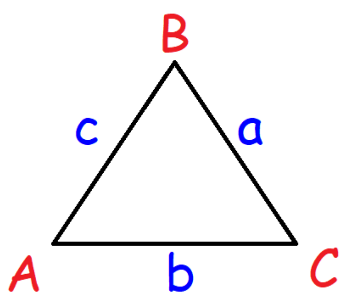
$$z^2 = x^2 + y^2$$

$$2z\frac{dz}{dt} = 2x\frac{dx}{dt} + 2y\frac{dy}{dt}$$

The Angle of Elevation:

$$\sin\theta = \frac{y}{z} \quad \cos\theta = \frac{x}{z} \quad \tan\theta = \frac{y}{x}$$

The Scalene Triangle:



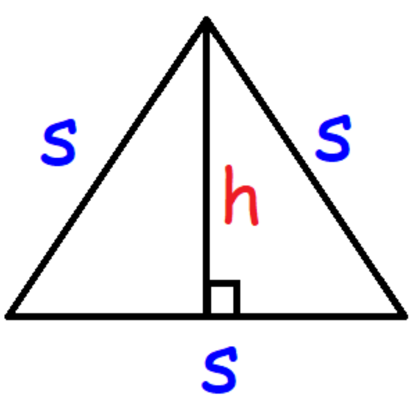
Area:

$$A = \frac{1}{2}\, ab\sin C$$

If 'a' and 'b' are constant:

$$\frac{dA}{dt} = \frac{1}{2} ab\cos C\, \frac{dC}{dt}$$

The Equilateral Triangle:



Area:

$$A = \frac{\sqrt{3}}{4}s^2 \qquad A = \frac{1}{2}sh$$

$$\frac{dA}{dt} = \frac{\sqrt{3}}{4}(2s)\frac{ds}{dt}$$

$$\frac{dA}{dt} = \frac{1}{2}\left(s\frac{dh}{dt} + h\frac{ds}{dt}\right)$$

The Height:

$$h = \frac{\sqrt{3}}{2}s$$

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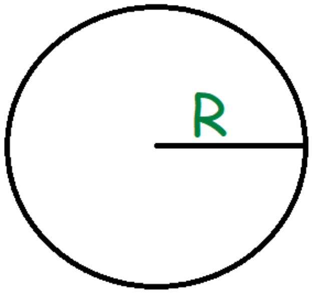
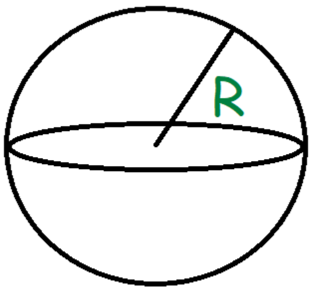
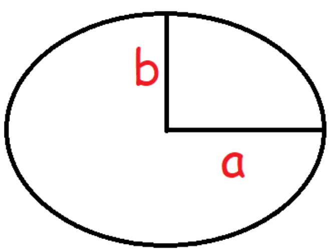
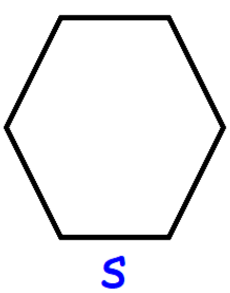
The Circle: 	**Circumference:** $C = 2\pi R$ **Diameter:** $d = 2R$ **The Area:** $A = \pi R^2$ $\frac{dA}{dt} = \pi(2R)\frac{dR}{dt}$
The Sphere: 	**The Volume:** $V = \frac{4}{3}\pi R^3$ $\frac{dV}{dt} = \frac{4}{3}\pi(3R^2)\frac{dR}{dt}$ **Surface Area:** $SA = 4\pi R^2$
The Ellipse: 	**The Area:** $A = \pi ab$ $\frac{dA}{dt} = \pi\left(a\frac{db}{dt} + b\frac{da}{dt}\right)$
The Hexagon: 	**The Area:** $A = \frac{3\sqrt{3}}{2}s^2$ $\frac{dA}{dt} = \frac{3\sqrt{3}}{2}(2s)\frac{ds}{dt}$ **The Perimeter:** $P = 6s$ $\frac{dP}{dt} = 6\frac{ds}{dt}$

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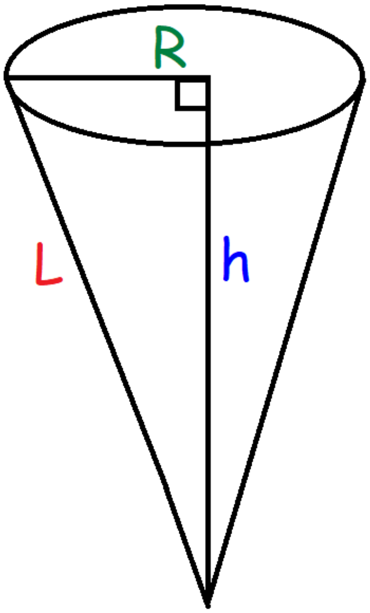
The Cone:



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Volume:

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

$$\frac{dV}{dt} = \frac{1}{3}\pi\left(2R\frac{dR}{dt}h + R^2\frac{dh}{dt}\right)$$

Lateral Surface Area:

$$LA = \pi R l$$

Surface Area:

$$SA = \pi R l + \pi R^2$$

The Slant Height:

$$l^2 = R^2 + h^2$$

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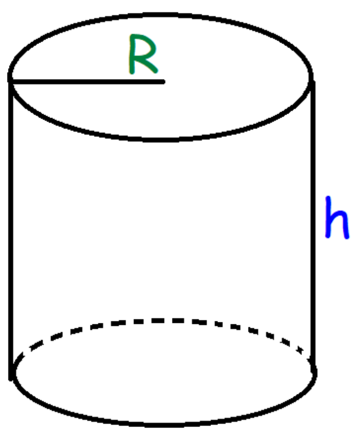
The Cylinder:



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Volume:

$$V = \pi R^2 h$$

$$\frac{dV}{dt} = \pi\left(2R\frac{dR}{dt}h + R^2\frac{dh}{dt}\right)$$

Lateral Surface Area:

$$LA = 2\pi R h$$

Surface Area:

$$SA = 2\pi R h + 2\pi R^2$$

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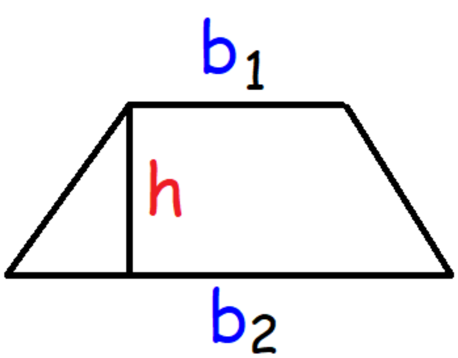
The Trapezoid:



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Area:

$$A = \frac{1}{2}(b_1 + b_2)h$$

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