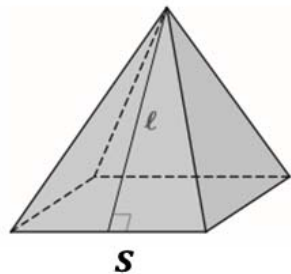Objective: Find the surface area of square pyramids

Concept

Surface Area of a Square Pyramid

Where P is the Perimeter of the base, B is the Base Area, and ℓ is the Slant Height
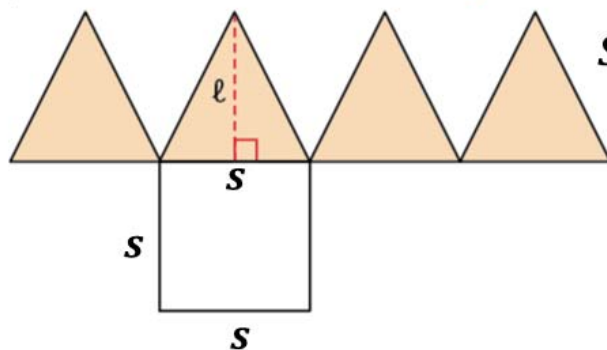
$$S = \frac{1}{2}P\ell + B$$

or

$$S = \frac{1}{2}(4s)\ell + s^2$$

Surface Area Using the Net

$$S = 4 \cdot \text{Area of a Triangular Side} + \text{Area of the Square Base}$$

$$S = 4\left(\frac{1}{2}s \cdot \ell\right) + s^2$$

$$\left(\frac{1}{2} \cdot b \cdot h\right)$$

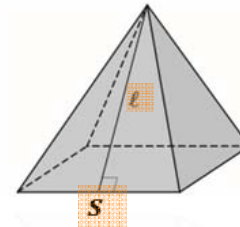Objective: Find the surface area of square pyramids

Concept

Steps to find the **Surface Area of a Square Pyramid** using $S = \frac{1}{2}P\ell + B$

Step 1: Find **P**, the **perimeter of the base** of the pyramid.

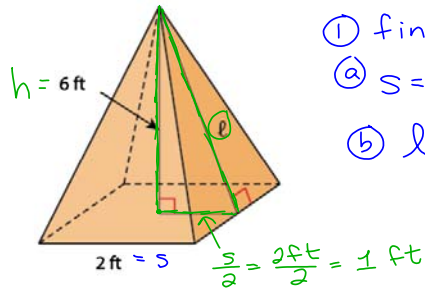Step 2: Find ℓ, the **slant height** of the pyramid.

Step 3: Find **B**, the **base area** of the pyramid. $B = s^2$

Step 4: Find **S**, **Surface Area**, by substituting $P, \ell,$ and B into $S = \frac{1}{2}P\ell + B$

Objective: Find the surface area of square pyramids
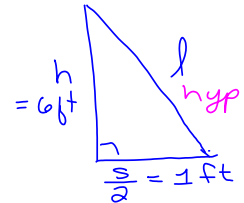
Ex) Grace is going to paint all surfaces of the square pyramid. Find the area that will be painted to the nearest tenth of a square foot.

$h = 6$ ft

① find s and ℓ

ⓐ $s = 2$ ft

ⓑ $\ell = ?$

2 ft $= s$

$\dfrac{s}{2} = \dfrac{2ft}{2} = 1$ ft

$\dfrac{h}{=6ft}$ ℓ hyp.

$\dfrac{s}{2} = 1$ ft
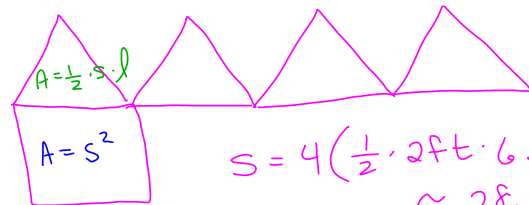
$6^2 + 1^2 = \ell^2$

$36 + 1 = \ell^2$

$37 = \ell^2$

$\ell = \sqrt{37} \approx 6.08$ ft

② surface area

ⓐ formula: $S = \dfrac{1}{2}(4s)\ell + s^2$

$= \dfrac{1}{2} \cdot 4 \cdot 2ft \cdot 6.08 ft + (2ft)^2$

≈ 28.3 ft²

ⓑ Net.

$A = \dfrac{1}{2} \cdot s \cdot \ell$

$A = s^2$

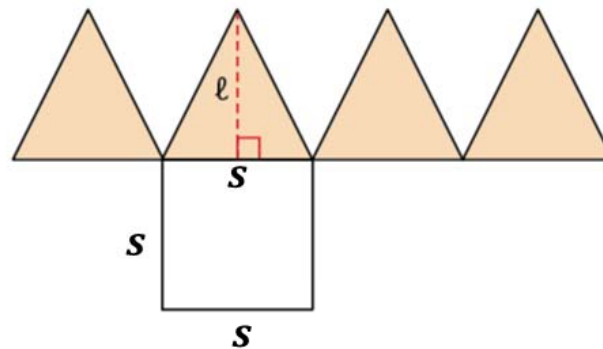$S = 4\left(\dfrac{1}{2} \cdot 2ft \cdot 6.08ft\right) + (2\,ft)^2$
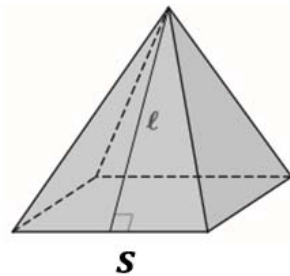
≈ 28.3 ft²

③ The area that will be painted is about 28.3 ft².

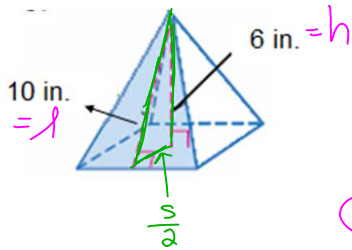Objective: Find the surface area of square pyramids

Concept

The **lateral area** of a square pyramid includes the area of _____ all four triangular sides. _____.

To calculate Lateral Area of a square pyramid, use: $4 \cdot \left(\dfrac{1}{2} \cdot s \cdot \ell \right)$

$$= 4 \left(\dfrac{s \cdot \ell}{2} \right)$$

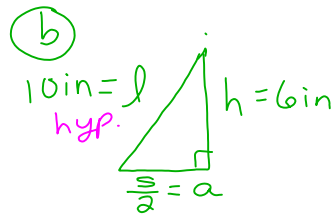Objective: Find the surface area of square pyramids

Ex) Josh is designing a stone sculpture shaped like a square pyramid. He is going to polish only the triangular sides of the pyramid. Determine the area of stone Josh will need to polish.

6 in. $= h$

10 in. $= l$

$\frac{s}{2}$

lateral area

$$L = 4\left(\frac{1}{2} \cdot s \cdot l\right) = 4\left(\frac{s \cdot l}{2}\right)$$

① find s and l

ⓐ $l = 10$ in

ⓑ

10 in $= l$ hyp.

$h = 6$ in

$\frac{s}{2} = a$

$a^2 + b^2 = c^2$

$a^2 + 6^2 = 10^2$

$a^2 + 36 = 100$

$a^2 = 64$

$\sqrt{a^2} = \sqrt{64}$

$a = 8 = \frac{s}{2}$

$S = 2 \cdot a$

$S = 2 \cdot 8 = 16$ in

② lateral area

$$L = 4\left(\frac{1}{2} \cdot s \cdot l\right)$$

$$= 4 \cdot \frac{1}{2} \cdot 16\text{in} \cdot 10\text{in} = 320 \text{ in}^2$$

③ Josh will need to polish 320 square inches of stone.

Objective: Find the surface area of square pyramids

Closure

Explain the difference between the height, h, and the slant height, ℓ, of a pyramid.

The height, h, is the perpendicular/vertical distance from the base to its apex. It is found inside the pyramid.
The slant height, ℓ, is the height of the triangular side of the pyramid. It is found on the surface of the pyramid.