C11 - 5.0 - Radicals + − × ÷

Index → $\sqrt[2]{3}$ ← Radicand

Type in Question.
Type in Answer.
Must be Same!

Adding and Subtracting : Like Radicals**:** Same radicand, same index. Add or subtract coefficients.

$\sqrt[2]{7}+\sqrt[2]{7}=2\sqrt[2]{7}$ $\boxed{x+x=2x}$

$5.29=5.29$

$1\sqrt[2]{3}+1\sqrt[2]{3}=2\sqrt[2]{3}$

$3.46=3.46$

$2\sqrt[2]{3}+5\sqrt[2]{3}=7\sqrt[2]{3}$

$12.12=12.12$

$4\sqrt[2]{2}-7\sqrt[2]{2}=-3\sqrt[2]{2}$

$-4.24=-4.24$

$\sqrt[2]{3}+\sqrt[2]{2}=\sqrt[2]{3}+\sqrt[2]{2}$

$1.71+1.41=3.15$

Cannot add/subtract unlike radicals.

Can only add/subtract like radicals.

$\sqrt[2]{5}+\sqrt[3]{5}+1=\sqrt[2]{5}+\sqrt[3]{5}+1$

$\sqrt[2]{12}+\sqrt[2]{27}+\sqrt[2]{18}+5$

$2\sqrt[2]{3}+3\sqrt[2]{3}+3\sqrt[2]{2}+5$

$5\sqrt[2]{3}+3\sqrt[2]{2}+5$

$17.9=17.9$

Simplify Roots

$\sqrt[2]{12}=\sqrt[2]{2\times2\times3}$

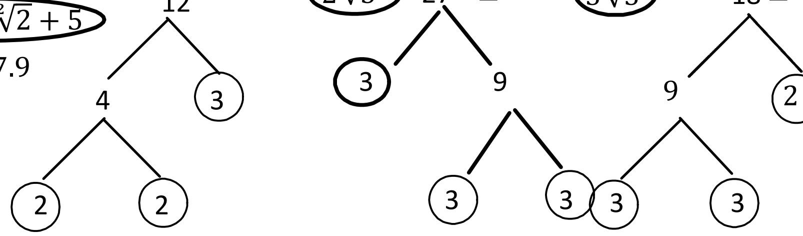
$12=\quad 2\sqrt[2]{3}$

$\sqrt[2]{27}=\sqrt[3]{3\times3\times3}$

$27=\quad 3\sqrt[3]{3}$

$\sqrt[2]{18}=\sqrt[2]{3\times3\times2}$

$18=\quad 3\sqrt[2]{2}$



Cube Roots :

$\sqrt[3]{7}+\sqrt[3]{7}=2\sqrt[3]{7}$

$3.83=3.83$

$\sqrt[3]{5}+\sqrt[3]{5}=2\sqrt[3]{5}$

$3.42=3.42$

$-2\sqrt[3]{3}-\sqrt[3]{24}=$

$-2\sqrt[3]{3}-2\sqrt[3]{3}=-4\sqrt[3]{5}$

$-6.84=-6.84$

$\sqrt[3]{24}=\sqrt[3]{2\times2\times2\times3}$

$=\quad 2\sqrt[3]{3}$

$2.88=2.88$

Multiplying & Dividing : Multiply Coefficients, Multiply Radicands

$\sqrt[2]{3}\times\sqrt[2]{3}=\sqrt[2]{3\times3}$

$=\sqrt[2]{9}$

$=3$

$\sqrt[2]{5}\times\sqrt[2]{3}=\sqrt[2]{5\times3}$

$=\sqrt[2]{15}$

$3.87=3.87$

$3\sqrt[2]{7}\times2\sqrt[2]{3}=3\times2\sqrt[2]{7\times3}$

$=6\sqrt[2]{21}$

$27.50=27.50$

$\frac{1}{2}\sqrt[2]{6}\times4\sqrt[2]{3}=\frac{1}{2}\times4\sqrt[2]{6\times3}$

$=\quad 2\sqrt[2]{18}$

$=\quad 2\times3\sqrt[2]{2}$

$=\quad 6\sqrt[2]{2}$

$3.49=8.49$

$7\times\sqrt{5}=7\sqrt{5}$

$\sqrt{5}\times7=7\sqrt{5}$

$13.23=13.23$

$2\times5\sqrt{3}=10\sqrt{3}$

$17.32=17.32$

$2\sqrt{5}\times\sqrt{3}=2\sqrt{15}$

$7.75=7.75$

$\sqrt[2]{5}\times\sqrt[3]{5}=\ \sqrt[2]{5}\times\sqrt[3]{5}=5^{\frac{1}{2}}\times5^{\frac{1}{3}}=5^{\frac{5}{6}}$

$3.82=3.82$

Can only multiply/divide like indexes.
Cannot multiply/divide unlike indexes.
Change Form, Add Exponents

Distribute :

$3(5+\sqrt{2})$

$15+3\sqrt{2}$

$19.24=19.24$

$(5+\sqrt{7})\sqrt{7}$

$5\sqrt{7}+7$

$20.23=20.23$

FOIL :

$(2-\sqrt[2]{3})\times(1+\sqrt[2]{5})$

$2+2\sqrt{5}-1\sqrt{3}-\sqrt{15}$

$0.867=0.867$

$(2+\sqrt{3})^2$

$(2+\sqrt{3})(2+\sqrt{3})$

…

$\frac{\sqrt[2]{6}}{\sqrt[2]{3}}=\sqrt[2]{\frac{6}{3}}$

$=\sqrt[2]{2}$

$1.41=1.41$

$\frac{10\sqrt[2]{6}}{2\sqrt[2]{3}}=\frac{10}{2}\sqrt[2]{\frac{6}{3}}$

$=5\sqrt[2]{2}$

$7.07=7.07$

$\frac{\sqrt{24}}{\sqrt{8}}=\frac{2\sqrt{6}}{2\sqrt{2}}=\frac{\sqrt{6}}{\sqrt{2}}=\sqrt{\frac{6}{2}}=\sqrt{3}$

$\sqrt{24}=2\sqrt{6}$

$\sqrt{8}=2\sqrt{2}$

$\boxed{\text{OR}}$

$\frac{\sqrt{24}}{\sqrt{8}}=\sqrt{\frac{24}{8}}=\sqrt{3}$

Simplify 1st

C11 - 5.0 - Radicals Rationalizing/Fractions Notes

Rationalize the Denominator :

$$\frac{5}{\sqrt[2]{3}} = \frac{5 \times \boxed{\sqrt[2]{3}}}{\sqrt[2]{3} \times \boxed{\sqrt[2]{3}}}$$

Multiply the top and bottom by the root in the denominator. Only the Root!

$$= \frac{5\sqrt[2]{3}}{\sqrt[2]{3 \times 3}}$$

$$= \frac{5\sqrt[2]{3}}{\sqrt[2]{9}} = \frac{5\sqrt[2]{3}}{3} = 2.89$$

Multiply the Top & Bottom by Conjugate of denominator.

Conjugate

$$\frac{5}{2 - \sqrt[2]{6}} = \frac{5 \times \boxed{(2 + \sqrt[2]{6})}}{(2 - \sqrt[2]{6}) \times \boxed{(2 + \sqrt[2]{6})}}$$

$$= \frac{10 + 5\sqrt[2]{6}}{-2}$$

Distribution

Foil

$$\boxed{\sqrt{6} \times \sqrt{6} = 6}$$

$$(2 - \sqrt[2]{6}) \times (2 + \sqrt[2]{6})$$

$$4 + 2\sqrt{6} - 2\sqrt{6} - 6$$

$$4 + \cancel{2\sqrt{6}} - \cancel{2\sqrt{6}} - 6$$

$$4 - 6$$

$$-2$$

$$-11.12 = -11.12$$

$$\frac{4}{\sqrt[2]{5} + \sqrt[2]{3}} = \frac{4 \times (\sqrt[2]{5} - \sqrt[2]{3})}{(\sqrt[2]{5} + \sqrt[2]{3}) \times (\sqrt[2]{5} - \sqrt[2]{3})}$$

$$= \frac{4\sqrt[2]{5} - 4\sqrt[2]{3}}{5 - 3}$$

$$= \frac{4\sqrt[2]{5} - 4\sqrt[2]{3}}{2} \boxed{\begin{matrix} \div 2 \\ \div 2 \end{matrix}}$$

$$= 2\sqrt{5} - 2\sqrt{3} \quad 1.01 = 1.01$$

$$\frac{5}{\sqrt[3]{3}} = \frac{5 \boxed{\times \sqrt[3]{3}} \boxed{\times \sqrt[3]{3}}}{\sqrt[3]{3} \boxed{\times \sqrt[3]{3}} \boxed{\times \sqrt[3]{3}}}$$

$$= \frac{5\sqrt[3]{9}}{3} = 3.47$$

Multiply the top and bottom by the cube root of the denominator twice. (Or three times for a fourth root etc.)

$$(a + b)(a - b)$$

$$a^2 - \cancel{ab} + \cancel{ab} - b^2$$

$$a^2 - b^2$$

$$\boxed{FOIL}$$

Rationalize 1st

$$\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} =$$

$$\frac{1}{\sqrt{2}}\frac{\times \sqrt{2}}{\times \sqrt{2}} + \frac{1}{\sqrt{3}}\frac{\times \sqrt{3}}{\times \sqrt{3}} =$$

$$\frac{3 \times \sqrt{2}}{3 \times 2} + \frac{\sqrt{3} \times 2}{3 \times 2} =$$

$$\frac{3\sqrt{2}}{6} + \frac{2\sqrt{3}}{6} =$$

$$\frac{3\sqrt{2} + 2\sqrt{3}}{6} =$$

Simplify (LCD)

$$\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} = 1.28$$

$$\frac{\sqrt{3} \times}{\sqrt{3} \times}\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}}\frac{\times \sqrt{2}}{\times \sqrt{2}} =$$

$$\frac{\sqrt{3}}{\sqrt{6}} + \frac{\sqrt{2}}{\sqrt{6}} =$$

$$\frac{\sqrt{3} + \sqrt{2}}{\sqrt{6}}\frac{\times \sqrt{6}}{\times \sqrt{6}} =$$

$$\frac{\sqrt{18} + \sqrt{12}}{6} =$$

$$\frac{3\sqrt{2} + 2\sqrt{3}}{6} = 1.28$$

$$\sqrt{\frac{2}{5}} + \sqrt{10} = 3.78$$

$$\frac{\sqrt{2}}{\sqrt{5}}\frac{\times \sqrt{5}}{\times \sqrt{5}} + \frac{\sqrt{10}}{1} =$$

$$\frac{\sqrt{10}}{5} + \frac{\sqrt{10}}{1} \times \frac{5}{5} =$$

$$\frac{\sqrt{10}}{5} + \frac{5\sqrt{10}}{5} =$$

$$\frac{6\sqrt{10}}{5} = 3.79$$

$$\sqrt{\frac{2}{5}} + \sqrt{10} =$$

$$\frac{\sqrt{2}}{\sqrt{5}} + \frac{\sqrt{10}}{1}\frac{\times \sqrt{5}}{\times \sqrt{5}} =$$

$$\frac{\sqrt{2}}{\sqrt{5}} + \frac{\sqrt{50}}{\sqrt{5}} =$$

$$\frac{\sqrt{2} + \sqrt{50}}{\sqrt{5}} =$$

$$\frac{\sqrt{2} + 5\sqrt{2}}{\sqrt{5}} =$$

$$\frac{6\sqrt{2}}{\sqrt{5}}\frac{\times \sqrt{5}}{\times \sqrt{5}} = \frac{6\sqrt{10}}{5}$$

$$\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{5} - 1} = 1.51$$

$$\frac{1}{\sqrt{2}}\frac{\times \sqrt{2}}{\times \sqrt{2}} + \frac{1}{(\sqrt{5} - 1)}\frac{\times (\sqrt{5} + 1)}{\times (\sqrt{5} + 1)} =$$

$$\frac{\sqrt{2} \times 2}{2 \times 2} + \frac{\sqrt{5} + 1}{4} =$$

$$\frac{2\sqrt{2} + \sqrt{5} + 1}{4} = 1.51$$

$$\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{5} - 1} = 1.51$$

$$\frac{(\sqrt{5} - 1) \times}{(\sqrt{5} - 1) \times}\frac{1}{\sqrt{2}} + \frac{1}{(\sqrt{5} - 1)}\frac{\times \sqrt{2}}{\times \sqrt{2}} =$$

$$\frac{(\sqrt{5} - 1 + \sqrt{2})}{(\sqrt{10} - \sqrt{2})}\frac{\times (\sqrt{10} + \sqrt{2})}{\times (\sqrt{10} + \sqrt{2})}$$

...

$$\frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{1 + \sqrt{5}} = \frac{\sqrt{3}}{\sqrt{2} + \sqrt{10}} = \cdots$$

C11 - 5.0 - Rad Eq's NPV's

$\boxed{\begin{array}{l}\sqrt{x} = -5 \\ \text{No Solution}\end{array}}$ ✗

A Square/Even Root Can't Equal a Negative.

$\sqrt{x+1} = x$

$x + 1 \geq 0$

$\cancel{x \geq -1}$

$x \geq 0$

A Root cant equal a Negative.

Solve Equations :

$$\sqrt{x+2} = 1$$
$$\left(\sqrt{x+2}\right)^2 = (1)^2$$
$$x + 2 = 1$$
$$x = -1$$

Square Both sides (Brackets)

$$\sqrt{x+2} = 1$$
$$\sqrt{(-1)+2} = 1$$
$$\sqrt{1} = 1$$

Check Answer

LHS=RHS

NPV's/Non-Permissible Values/Restrictions

$$x + 2 \geq 0$$
$$-2 \quad -2$$
$$x \geq -2$$

Restrictions: Set underneath root ≥ 0 and solve.

$$2\sqrt{x+2} + 1 = 7$$
$$-1 \quad -1$$
$$2\sqrt{x+2} = 6$$
$$\sqrt{x+2} = 3$$
$$\left(\sqrt{x+2}\right)^2 = (3)^2$$
$$x + 2 = 9$$
$$-2 \quad -2$$
$$x = 7$$

Isolate Root Algebra

OR

$$\left(2\sqrt{x+2}\right)^2 = (6)^2$$
$$4(x+2) = 36$$
$$\ldots$$

$$\sqrt{x+3} = \sqrt{2x+5}$$
$$\left(\sqrt{x+3}\right)^2 = \left(\sqrt{2x+5}\right)^2$$
$$x + 3 = 2x + 5$$
$$-x \quad -x$$
$$3 = x + 5$$
$$-5 \quad -5$$
$$x = -2$$

$$(2x+3)^2 = (x+7)^2$$
$$\sqrt{(2x+3)^2} = \sqrt{(x+7)^2}$$
$$2x + 3 = x + 7$$
$$x = 4$$

Square Root Both Sides

$$4x^2 + 12x + 9 = x^2 + 14x + 49$$
$$3x^2 - 2x - 40 = 0$$
$$(3x+10)(x-4) = 0$$
$$3x + 10 = 0$$
$$x = -\frac{10}{3}$$

$$\sqrt{x+3} - x - 1 = 0$$
$$\sqrt{x+3} = x + 1 \quad \boxed{LHS = RHS}$$
$$\left(\sqrt{x+3}\right)^2 = (x+1)^2$$
$$x + 3 = (x+1)(x+1)$$
$$x + 3 = x^2 + 2x + 1$$
$$0 = x^2 + x - 2$$
$$0 = (x+2)(x-1)$$

$x + 2 = 0$, $\cancel{x = -2}$ $\qquad$ $x - 1 = 0$, $x = 1$

$$\sqrt{x+3} = x + 1$$
$$\sqrt{-2+3} = -2 + 1$$
$$1 \neq -1$$

$$\sqrt{x+3} = x + 1$$
$$\sqrt{1+3} = 1 + 1$$
$$2 = 2$$

$$x + 3 \geq 0$$
$$x \geq -3$$

$$\sqrt{x-5} - \sqrt{x-8} = 1$$
$$\sqrt{x-5} = \sqrt{x-8} + 1$$
$$\left(\sqrt{x-5}\right)^2 = \left(\sqrt{x-8}+1\right)^2$$
$$x - 5 = \left(\sqrt{x-8}+1\right)\left(\sqrt{x-8}+1\right)$$
$$x - 5 = x - 8 + 2\sqrt{x-8} + 1$$
$$1 = \sqrt{x-8}$$
$$(1)^2 = \left(\sqrt{x-8}\right)^2$$
$$1 = x - 8$$
$$x = 9$$

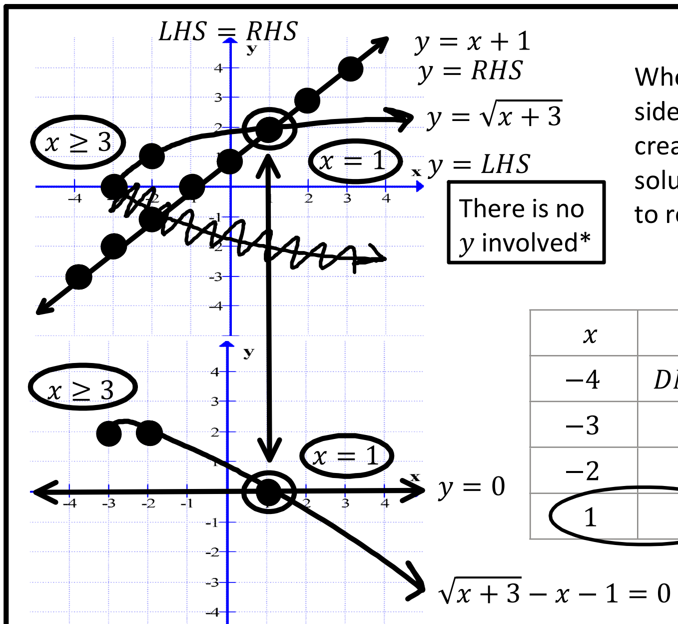
$x - 5 \geq 0$, $\cancel{x \geq 5}$ $\qquad$ $x - 8 \geq 0$, $x \geq 8$

$$\sqrt{x-5} - \sqrt{x-8} = 1$$
$$\sqrt{9-5} - \sqrt{9-8} = 1$$
$$1 = 1$$

$$\sqrt{x+1} = \sqrt{x} + 1$$
$$\left(\sqrt{x+1}\right)^2 = \left(\sqrt{x}+1\right)^2$$
$$x + 1 = \left(\sqrt{x}+1\right)\left(\sqrt{x}+1\right)$$
$$x + 1 = x + \sqrt{x} + \sqrt{x} + 1$$
$$0 = 2\sqrt{x}$$
$$(0)^2 = \left(2\sqrt{x}\right)^2$$
$$0 = 4x$$
$$x = 0$$

$x + 1 \geq 0$, $\cancel{x \geq -1}$ $\qquad$ $x \geq 0$

$$\sqrt{x+1} = \sqrt{x} + 1$$
$$\sqrt{0+1} = \sqrt{0} + 1$$
$$0 = 0$$



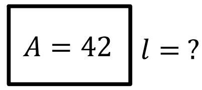
There is no y involved*

When you square both sides you potentially create an artificial solution you may need to reject.

x	y
-4	DNE
-3	2
-2	2
1	0

C11 - 5.0 - Radicals Geometry/Formula WPs

Find Length



$\sqrt{6}$

$A = lw$

$42 = l\sqrt{6}$

$l = \frac{42}{\sqrt{6}}$

$l = \frac{42}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}}$

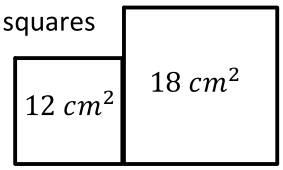
$l = \frac{42\sqrt{6}}{6}$

$l = 7\sqrt{6}$

Find Perimeter of joined squares

$let\ x = short\ side$

$let\ y = long\ side$



$A = lw$

$18 = y^2$

$\sqrt{18} = \sqrt{y^2}$

$x = 3\sqrt{2}$

$A = lw$

$12 = x^2$

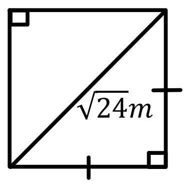
$\sqrt{12} = \sqrt{x^2}$

$x = 2\sqrt{3}$

$P = 2\sqrt{3} + 2\sqrt{3} + 2\sqrt{3} + (3\sqrt{2} - 2\sqrt{3}) + 3\sqrt{2} + 3\sqrt{2} + 3\sqrt{2} = (4\sqrt{3} + 12\sqrt{2})cm$

Find P & A

$let\ x = side$



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

$x^2 + x^2 = (\sqrt{24})^2$

$2x^2 = 24$

$x^2 = 12$

$x = \sqrt{12}$

$x = 2\sqrt{3}$

$P = 4s$

$P = 4(2\sqrt{3})$

$P = 8\sqrt{3}m$

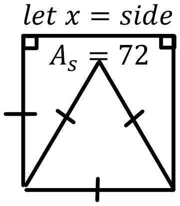
$A = s^2$

$A = (\sqrt{12})^2$

$A = 12m^2$

Find P_t and A_t

$let\ x = side$

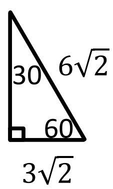


$x = 6\sqrt{2}$

$P = 6\sqrt{2} + 6\sqrt{2} + 6\sqrt{2}$

$P = 18\sqrt{2}$

$h = 3\sqrt{6}$



$A = lw$

$72 = x^2$

$\sqrt{72} = \sqrt{x^2}$

$x = 6\sqrt{2}$

$b = \frac{6\sqrt{2}}{2} = 3\sqrt{2}$

$A = \frac{bh}{2}$

$A = \frac{3\sqrt{2}(3\sqrt{6})}{2}$

$A = \frac{9\sqrt{12}}{2}$

$A = \frac{18\sqrt{3}}{2}$

$A = 9\sqrt{3}$

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

$h = \sqrt{c^2 - a^2}$

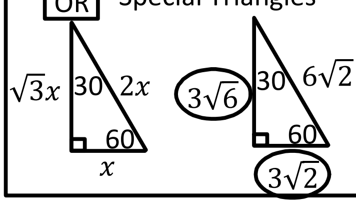
$h = \sqrt{(6\sqrt{2})^2 - (3\sqrt{2})^2}$

$h = \sqrt{72 - 18}$

$h = \sqrt{54}$

$h = 3\sqrt{6}$

OR Special Triangles



A ball is shot straight down where :

$v_f = \sqrt{v_i^2 + 19.6h}$

$v_f = final\ velocity\ m/s$

$v_i = initial\ velocity\ m/s$

$h = height\ m$

Find $v_i\ if\ v_f = 14.1\frac{m}{s}$ $and\ h = 5m.$

$v_f = \sqrt{v_i^2 + 19.6h}$

$14.1 = \sqrt{v_i^2 + 19.6(5)}$

$(14.1)^2 = \left(\sqrt{v_i^2 + 19.6(5)}\right)^2$

$198.81 = v_i^2 + 98$

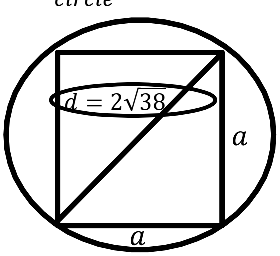
$v_i^2 = 100.81$

$\sqrt{v_i^2} = \sqrt{100.81}$

$v_i = 10\frac{m}{s}$

$Find\ P_s\ \&\ A_s$

$A_{circle} = 38\,\pi\ m^2$



$A = \pi r^2$

$38\pi = \pi r^2$

$r^2 = 38$

$r = \sqrt{38}$

$d = 2\sqrt{38}$

$c = \sqrt{a^2 + b^2}$

$d = \sqrt{a^2 + a^2}$

$2\sqrt{38} = \sqrt{2a^2}$

$\frac{2\sqrt{38}}{\sqrt{2}} = \frac{\sqrt{2}a}{\sqrt{2}}$

$a = 2\sqrt{19}$

$A = lw$

$A = 2\sqrt{19}(2\sqrt{19})$

$A = 76\ m^2$

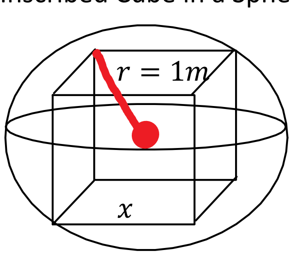
$P = 4a$

$P = 4(2\sqrt{19})$

$P = 8\sqrt{19}\ m$

Find Cube SA.

Inscribed Cube in a Sphere.



Diagonal of a cube

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

$2^2 = 3x^2$

$x^2 = \frac{4}{3}$

$x = \frac{2}{\sqrt{3}}$

$SA_{cube} = 6x^2$

$SA_{cube} = 6\left(\frac{2}{\sqrt{3}}\right)^2$

$SA_{cube} = 6\left(\frac{4}{3}\right)$

$SA_{cube} = 8\ m^2$