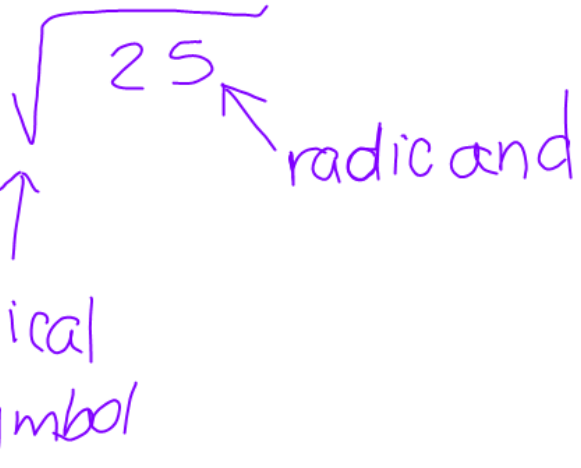
# 3.8 - Estimating Square Roots

**Vocabulary:**

- Perfect Square
- Radicand

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 9 | 16 | 25 | 36 | 49 | 64 | 81 | 100 |
| $1^2$ | $2^2$ | $3^2$ | $4^2$ | $5^2$ | $6^2$ | $7^2$ | $8^2$ | $9^2$ | $10^2$ ... |



**1 EXAMPLE** Simplify each expression.

$5 \cdot 5 = 25$

$-5 \cdot -5 = 25$

**a.** $\sqrt{25}$ $\pm 5$

**b.** $\pm\sqrt{\frac{9}{25}}$ $\frac{\sqrt{9}}{\sqrt{25}} = \pm\frac{3}{5}$

**c.** $-\sqrt{64}$ $-8$

**d.** $\sqrt{-49}$ = not a real #

**e.** $\sqrt{\frac{1}{16}}$ $\frac{\sqrt{1}}{\sqrt{16}} = \pm\frac{1}{4}$

**Simplify each expression.**

**1.** $\sqrt{169}$

$\pm 13$

**2.** $\sqrt{400}$

$\pm 20$

**3.** $\sqrt{\frac{1}{9}}$

$\pm \frac{1}{3}$

**4.** $\sqrt{900}$

$\pm 30$

**2 EXAMPLE** Tell whether each expression is *rational* or *irrational*.

**a.** $\pm\sqrt{144}$ $\pm 12$ rational

**b.** $-\sqrt{\frac{1}{5}} = -\frac{\sqrt{1}}{\sqrt{5}} = -\frac{1}{2.23606\ldots}$ irrational

**c.** $-\sqrt{6.25}$ $-2.5$ rational

**d.** $\sqrt{\frac{1}{9}}$ $\frac{\sqrt{1}}{\sqrt{9}} = \pm\frac{1}{3}$ rational

**e.** $\sqrt{7}$ $2.64\ldots$ irrational

**Tell whether each expression is *rational* or *irrational*.**

**13.** $\sqrt{37}$

irrational

**15.** $\pm\sqrt{\frac{1}{5}}$

irrational

**3 EXAMPLE** Between what two consecutive integers is $\sqrt{28.34}$ ?

$\sqrt{25}$ $\sqrt{36}$

$5 \neq 6$

**Between what two consecutive integers is each square root?**

**17.** $\sqrt{35}$

$\sqrt{25}$ $\sqrt{36}$

5 & 6

**19.** $-\sqrt{130}$

$\sqrt{121}$ $\sqrt{144}$

$-11$ & $-12$

**4 EXAMPLE** Find $\sqrt{28.34}$ to the nearest hundredth.

5.3235

5.32

**Use a calculator to find each square root to the nearest hundredth.**

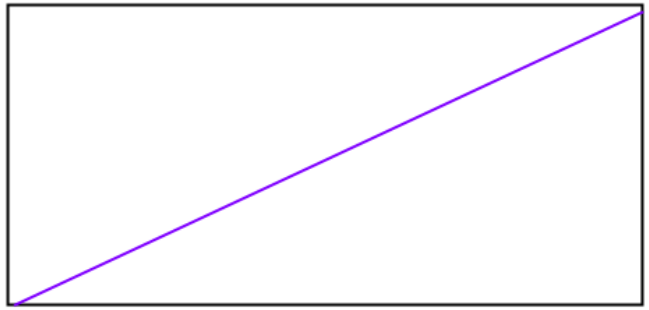
**21.** $\sqrt{12}$

3.46

**23.** $\sqrt{11{,}550}$

107.47

**5 EXAMPLE** Suppose a rectangular field has a length three times its width $x$. The formula $d = \sqrt{x^2 + (3x)^2}$ gives the distance of the diagonal of a rectangle. Find the distance of the diagonal across the field if $x = 8$ ft.



$d = \sqrt{8^2 + (3 \cdot 8)^2}$

$= \sqrt{64 + 576}$

$= \sqrt{640}$

$= 25.29$ ft.

**39. Multiple Choice** The formula $d = \sqrt{12{,}800h + h^2}$ gives the distance $d$ in kilometers to the horizon from a satellite $h$ kilometers above Earth. Find the distance to the horizon from a satellite 4200 km above Earth. Round to the nearest kilometer.

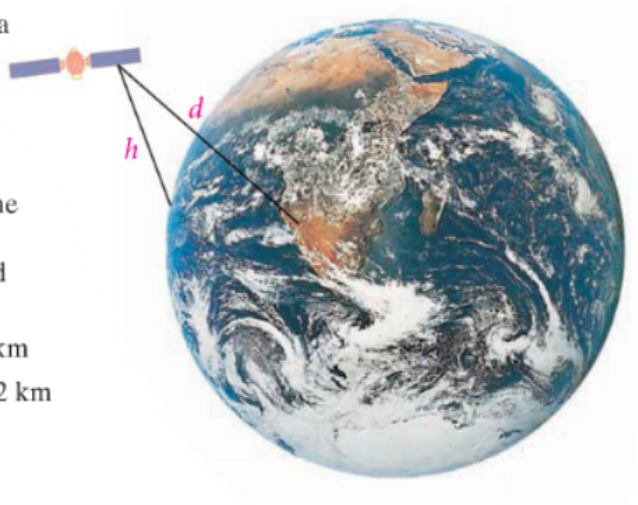
(A) 130 km (B) 7333 km

(C) 8450 km (D) 11,532 km

$d = \sqrt{12{,}800 \cdot 4200 + 4200^2}$

$d = \sqrt{53{,}760{,}000 + 17{,}640{,}000}$

$= 8{,}449$



Homework: pg. 178 #6, 10, 14-24even, 38, 58, 64, 73