Chapter 9
Real Numbers and Right Triangles
Chapter 9

9.1 Square Roots
9.2 Simplifying Square Roots
9.3 Pythagorean Theorem
9.4 Real Numbers
9.5 Distance and Midpoint Formulas
9.6 Special Right Triangles
9.7 The Tangent Ratio
9.8 The Sine and Cosine Ratios
I can write all perfect squares from 1 to 625.

I can find and approximate square roots.
Perfect Square

Definition:
“a number that is the square of an integer”

List all the perfect squares from 1 – 625!
# Perfect Squares

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$1^2$</td>
<td>$2^2$</td>
<td>$3^2$</td>
<td>$4^2$</td>
<td>$5^2$</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>9</td>
<td>16</td>
<td>25</td>
</tr>
<tr>
<td>$6^2$</td>
<td>$7^2$</td>
<td>$8^2$</td>
<td>$9^2$</td>
<td>$10^2$</td>
</tr>
<tr>
<td>36</td>
<td>49</td>
<td>64</td>
<td>81</td>
<td>100</td>
</tr>
<tr>
<td>$11^2$</td>
<td>$12^2$</td>
<td>$13^2$</td>
<td>$14^2$</td>
<td>$15^2$</td>
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<tr>
<td>121</td>
<td>144</td>
<td>169</td>
<td>196</td>
<td>225</td>
</tr>
<tr>
<td>$16^2$</td>
<td>$17^2$</td>
<td>$18^2$</td>
<td>$19^2$</td>
<td>$20^2$</td>
</tr>
<tr>
<td>256</td>
<td>289</td>
<td>324</td>
<td>361</td>
<td>400</td>
</tr>
<tr>
<td>$21^2$</td>
<td>$22^2$</td>
<td>$23^2$</td>
<td>$24^2$</td>
<td>$25^2$</td>
</tr>
<tr>
<td>441</td>
<td>484</td>
<td>529</td>
<td>576</td>
<td>625</td>
</tr>
</tbody>
</table>

Memorize this Table!
Square Root

**Definition:**

“A square root of a number $n$ is a number such that $m^2 = n$.”

Taking the square root of a number is the opposite of squaring a number.
Square Root

A number has both a POSITIVE square root and a NEGATIVE square root.

\[ 9^2 = 81 \quad \text{and} \quad (-9)^2 = 81 \]

The radical sign represents a nonnegative square root.

\[ \sqrt{81} = 9 \]
\[ -\sqrt{81} = -9 \]
Square Root

Examples:

\[ \sqrt{100} \quad \sqrt{64} \quad \sqrt{16} \quad \sqrt{144} \]

10 \quad 8 \quad 4 \quad 12
Square Root of Perfect Squares

The square root of a perfect square is an integer.

\[ \sqrt{81} = 9 \]

You can use perfect squares to approximate a square root of a number.
Approximating a Square Root

Approximate $\sqrt{51}$ to the nearest integer.

$49 < 51 < 64$ Identify perfect squares closest to 51

$\sqrt{49} < \sqrt{51} < \sqrt{64}$ Take positive square root of each number

$7 < \sqrt{51} < 8$ Evaluate square root of each perfect square

**Answer:** The average of 7 and 8 is 7.5, and $(7.5)^2$ is 56.25. Because 51 < 56.25, $\sqrt{51}$ is closer to 7 than to 8. Therefore, to the nearest integer, $\sqrt{51} \approx 7$
Approximating a Square Root

Approximate the square root to the nearest integer

Examples:

\[
\begin{array}{cc}
\sqrt{28} & \approx 5 \\
\sqrt{125} & \approx 11 \\
\sqrt{93} & \approx 10 \\
\end{array}
\]
Radical Expression

Definition:

“an expression that involves a radical sign”

\[ \sqrt{a^2 - b} \]

When you evaluate a radical expression, first evaluate the expression under the radical symbol before finding the square root.
Evaluating a Radical Expression

Evaluate $2\sqrt{a + b^2}$ when $a = 11$ and $b = 5$

$2\sqrt{11 + 5^2}$

Substitute 11 for $a$ and 5 for $b$

$2\sqrt{36}$

Evaluate expression under the radical symbol

$2 * 6 = 12$

Evaluate square root. Multiply.
Evaluating a Radical Expression

Evaluate $\sqrt{4b + a}$ when $a = 1$ and $b = 2$

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Evaluate $5\sqrt{a^2 + 4b}$ when $a = 2$ and $b = 3$

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