Unit 11 Notes
Rational and Irrational Numbers
Pythagorean Theorem

Tentative Schedule

Day	Classwork	Assignment
Thurs. 5/30	Rational vs. Irrational Numbers	Study the first 15 perfect squares
Fri. 5/1 Mon. 5/4	**Quiz on Perfect Squares** Simplifying Radicals	None
Tues. 5/5	Work on P.S. #11.1	Finish P.S. #11.1
Wed. 5/6 Thurs. 5/7	Pythagorean Theorem	P.S. #11.2
Fri. 5/8	Applications of Pythagorean Theorem	P.S. #11.3
Mon. 5/11 Tues. 5/12	Distance Formula	P.S. #11.4
Wed. 5/13	Review Game	Review for Quest #11
Thurs. 5/14 Fri. 5/15	**Quest #11**	Begin Polynomials Unit

Name: ____

Notes 11.1 – Rational vs. Irrational and Simplifying Radicals

Fill in the following chart.

$1^2 =$ 1	$2^2 =$ 4	$3^2 =$ 9	$4^2 =$ 16	$5^2 =$ 25
$6^2 =$ 36	$7^2 =$ 49	$8^2 =$ 64	$9^2 =$ 81	$10^2 =$ 100
$11^2 =$ 121	$12^2 =$ 144	$13^2 =$ 169	$14^2 =$ 196	$15^2 =$ 225

Evaluate the following.

1.) $\sqrt{81}$ 9

2.) $\sqrt{25}$ 5

3.) $\sqrt{49}$ 7

4.) $\sqrt{225}$ 15

5.) $\sqrt{169}$ 13

6.) $\sqrt{-81}$ non real (no # can be multiplied by itself to get -81.)

7.) $-\sqrt{25}$ -5

8.) $\sqrt{-49}$ non-real

9.) $\sqrt{-225}$ non-real

10.) $-\sqrt{169}$ -13

Rational Numbers	Irrational Numbers
Definition	**Definition**
• a # that either terminates or repeats • can be expressed as a fraction.	• a # that doesn't terminate or repeat • can't be expressed as a fraction
Examples	**Examples**
$8 (8/1)$, $0.\overline{3} (1/3)$, $-4.1 (\frac{-41}{10})$ $\sqrt{9}$ (3)	π, 4.182371925... $\sqrt{2}$

Identify whether the numbers below are rational or irrational. Explain why.

11.) 4 Rational
- ends
- can be written as a fraction. (4/1)

12.) π Irrational
- doesn't end or repeat
- can't be written as a fraction.

13.) $\sqrt{25}$ Rational
- ends
- can be written as a fraction. $\left(\frac{5}{1}\right)$

14.) $\sqrt{11}$ Irrational
- doesn't end or repeat
- can't be written as a fraction.

15.) $-\frac{2}{3}$ Rational
- repeats $(0.\overline{6})$
- can be written as a fraction

16.) $\frac{3}{5}$ Rational
- ends (0.6)
- can be written as a fraction.

17.) 3.14 Rational
- ends
- can be written as a fraction. $\left(3\frac{14}{100}\right)$

18.) −1,234,567 Rational
- ends
- can be written as a fraction. $\left(\frac{-1234567}{1}\right)$

19.) 1.10110111011110... Irrational
- doesn't end or repeat
- can't be written as a fraction.

Simplifying Radicals

To Simplify Radicals	Example: $\sqrt{80}$
1. Factor the number under the radical sign, if possible, so that one of its factors is the *largest possible* perfect square.	1. 80: 1 | 80, 4 | 20, 16 | 5
2. You are allowed to split up a radical sign if there is multiplication underneath it.	2. $\sqrt{80} = \sqrt{16 \cdot 5} = \sqrt{16}\sqrt{5}$
3. Evaluate the square root of the perfect square and leave the other factor underneath the radical sign.	3. $\boxed{4\sqrt{5}}$

Simplify the radicals below:

20.) $\sqrt{200}$

200: 1 | 200, 4 | 50, 25 | 8, 100 | 2

$\sqrt{100 \cdot 2}$

$\sqrt{100}\sqrt{2}$

$\boxed{10\sqrt{2}}$

21.) $\sqrt{32}$

32: 1 | 32, 4 | 8, 16 | 2

$\sqrt{16 \cdot 2}$

$\sqrt{16}\sqrt{2}$

$\boxed{4\sqrt{2}}$

22.) $\sqrt{17}$

17 is prime

$\sqrt{17}$

23.) $\sqrt{81}$

$\boxed{9}$

24.) $\sqrt{52}$

52: 1 | 52, 4 | 13

$\sqrt{4 \cdot 13}$

$\sqrt{4}\sqrt{13}$

$\boxed{2\sqrt{13}}$

25.) $5\sqrt{24}$

24: 1 | 24, 4 | 6

$5\sqrt{24}$

$5\sqrt{4 \cdot 6}$

$5\sqrt{4}\sqrt{6}$

$5 \cdot 2\sqrt{6}$

$\boxed{10\sqrt{6}}$

26.) $\dfrac{\sqrt{20}}{2}$

20: 1 | 20, 4 | 5

$\dfrac{\sqrt{20}}{2}$

$\dfrac{\sqrt{4}\sqrt{5}}{2}$

$\dfrac{\cancel{2}\sqrt{5}}{\cancel{2}} = \sqrt{5}$

27.) $\sqrt{27x^3}$

27: 1 | 27, 9 | 3

x^3: x^2 | x

$\sqrt{27x^3}$

$\sqrt{9x^2}\sqrt{3x}$

$\boxed{3x\sqrt{3x}}$

28.) $\sqrt{44u^5}$

44: 1 | 44, 4 | 11

u^5: u^2 | u^3, u^4 | u

$\sqrt{4u^4}\sqrt{11u}$

$2u^2\sqrt{11u}$

Notes 11.2 - Pythagorean Theorem

Solve the following equations.

1.) $\sqrt{x^2} = \sqrt{16}$

$x = 4$

2.) $\sqrt{a^2} = \sqrt{9}$

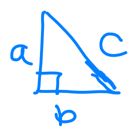
$a = 3$

Right Triangles

Definition:

a 3-sided polygon w/ a 90° angle

Drawing:



a, b → legs

c → hypotenuse (longest side)

In order for a triangle to be a right triangle, it has to satisfy the following equation:

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

This is called the Pythagorean Theorem.

Indicate whether the following are right triangles:

3.) 3,4,5 $a=3$ $b=4$ $c=5$

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

$3^2 + 4^2 = 5^2$

$9 + 16 = 25$

$25 = 25$ ✓

yes

4.) 5,7,13 $a=5$ $b=7$ $c=13$

$5^2 + 7^2 = 13^2$

$25 + 49 = 169$

$74 \neq 169$

no

5.) $3, \sqrt{27}, 6$ $a=3$ $b=\sqrt{27}$ $c=6$

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

$3^2 + (\sqrt{27})^2 = 6^2$

$9 + 27 = 36$

$36 = 36$ ✓

yes!

6.) 2,4,9 $a=2$ $b=4$ $c=9$

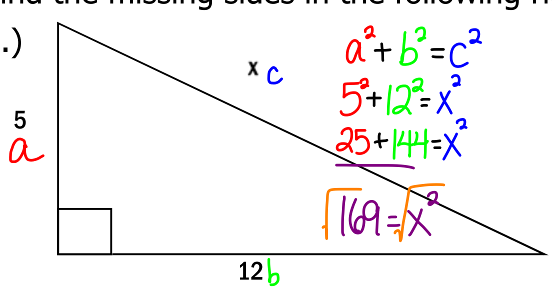
$2^2 + 4^2 = 9^2$

$4 + 16 = 81$

$20 = 81$ × $\boxed{\text{no}}$

Find the missing sides in the following right triangles.

7.)



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

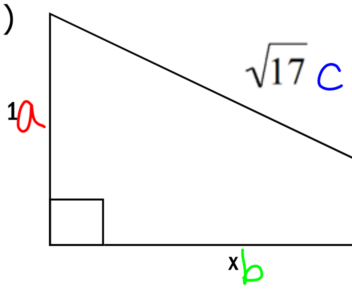
$5^2 + 12^2 = x^2$

$25 + 144 = x^2$

$\sqrt{169} = \sqrt{x^2}$

$\boxed{13} = x$

8.)



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

$1^2 + x^2 = (\sqrt{17})^2$

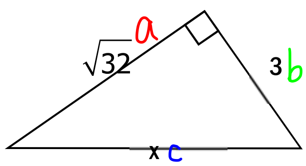
$1 + x^2 = 17$

$-1 \qquad -1$

$\sqrt{x^2} = \sqrt{16}$

$\boxed{x = 4}$

9.)



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

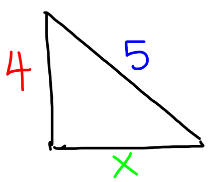
$(\sqrt{32})^2 + 3^2 = x^2$

$32 + 9 = x^2$

$\sqrt{41} = \sqrt{x^2}$

$\boxed{\sqrt{41}} = x$

10.) A 5-foot ladder rests against a 4-foot vertical wall. How far away from the wall is the foot of the ladder? **Draw a picture.**



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

$4^2 + x^2 = 5^2$

$16 + x^2 = 25$

$-16 \qquad -16$

$\sqrt{x^2} = \sqrt{9}$

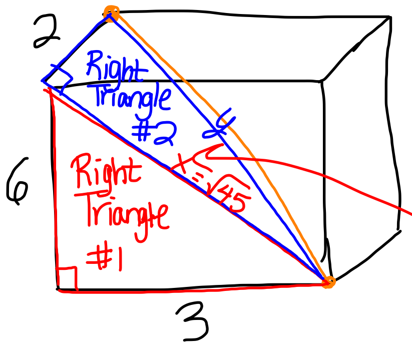
$x = 3$

$\boxed{3 \text{ ft}}$

Notes 11.3 - Applications of Pythagorean Theorem

Find the length of the longest pole that will fit inside a truck trailer. A truck is 6 m x 2 m x 3 m.

(pole = orange line)



Triangle #1:

$$6^2+3^2=x^2$$
$$36+9=x^2$$
$$45=x^2$$
$$\sqrt{45}=x$$

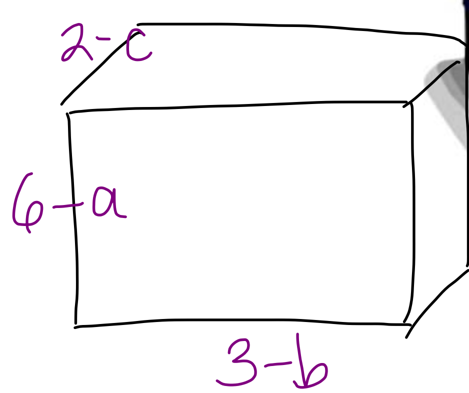
Triangle #2:

$$2^2+(\sqrt{45})^2=x^2$$
$$4+45=x^2$$
$$\sqrt{49}=\sqrt{x^2}$$
$$7=x$$

$$\boxed{7\text{ ft}}$$

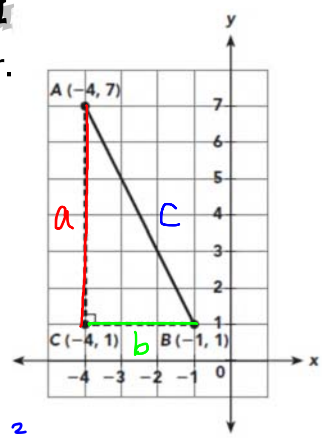
OR

$$D=a^2+b^2+c^2$$
$$D^2=6^2+3^2+2^2$$
$$D^2=36+9+4$$
$$\sqrt{D^2}=\sqrt{49}$$
$$\boxed{D=7\text{ ft}}$$



Notes 11.4 - Distance Formula

1.) Find the distance of all three sides of the triangle. Simplify the answer.



$\boxed{AC = 6 \quad BC = 3 \quad AB = 3\sqrt{5}}$

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

$6^2 + 3^2 = x^2$

$36 + 9 = x^2$

$\sqrt{45} = \sqrt{x^2}$

$\sqrt{9 \cdot 5} = x$

$x = \sqrt{9}\sqrt{5}$

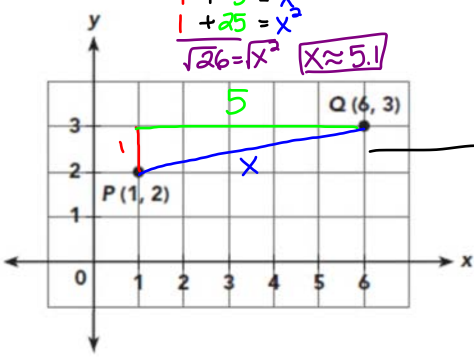
$x = 3\sqrt{5}$

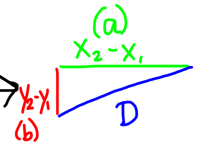
2.) Points P (1, 2) and Q (6, 3) are plotted on a coordinate plane. Find the distance between points P and Q. Round your answer to the nearest tenth.

$1^2 + 5^2 = x^2$

$1 + 25 = x^2$

$\sqrt{26} = \sqrt{x^2}$ $\boxed{x \approx 5.1}$





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

$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{D^2}$

$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = D$

The Distance Formula:

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

3.) Find the lengths of all three sides of the triangle. Simplify the radical, if possible.

$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

AB: A(4, 1) B(0, 3)

$D = \sqrt{(0 - 4)^2 + (3 - 1)^2}$

$D = \sqrt{(-4)^2 + (2)^2} = \sqrt{16 + 4} = \sqrt{20} = \sqrt{4}\sqrt{5} = 2\sqrt{5}$

AC: A(4, 1) C(3, -4)

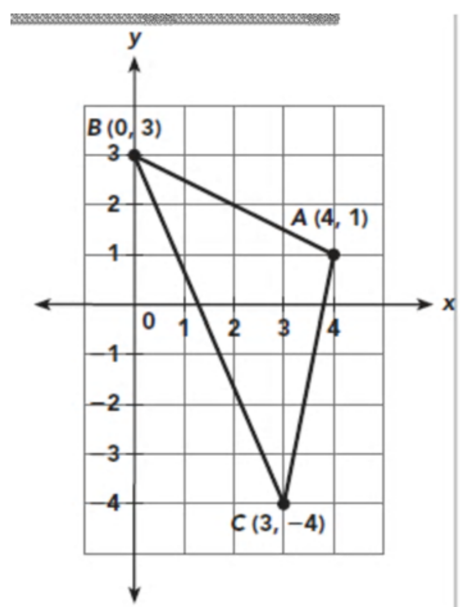
$D = \sqrt{(3 - 4)^2 + (-4 - 1)^2}$

$D = \sqrt{(-1)^2 + (-5)^2} = \sqrt{1 + 25} = \sqrt{26}$

BC: B(0, 3) C(3, -4)

$D = \sqrt{(3 - 0)^2 + (-4 - 3)^2}$

$D = \sqrt{(3)^2 + (-7)^2} = \sqrt{9 + 49} = \sqrt{58}$



AB $= 2\sqrt{5}$	AC $= \sqrt{26}$	BC $= \sqrt{58}$