

Math 116
Test 1 Review

Possible questions

1) Convert 1246 to a binary number.

First Check all power of 2 that divide 1246

$$2^0 = 2$$

$$2^1 = 2$$

$$2^2 = 4$$

$$2^3 = 8$$

$$2^4 = 16$$

$$2^5 = 32$$

$$2^6 = 64$$

$$2^7 = 128$$

$$2^8 = 256$$

$$2^9 = 512$$

$$2^{10} = 1024$$

Thus, $1246 = 1024 + 22$

Then, $243 = 2^{10} + 222$

Find the greatest power of two that divides 222 which is $2^7 = 128$

So, $1246 = 2^{10} + 128 + 94$

Keep repeating the process until the remainder is 1 or 0

$$\Rightarrow 1246 = 2^{10} + 2^7 + 64 + 30$$

$$\Rightarrow 243 = 2^{10} + 2^7 + 2^6 + 2^6 + 16 + 14$$

$$\Rightarrow 243 = 2^{10} + 2^7 + 2^6 + 2^4 + 8 + 6$$

$$\Rightarrow 243 = 2^{10} + 2^7 + 2^6 + 2^4 + 2^3 + 4 + 2$$

$$\Rightarrow 243 = 2^{10} + 2^7 + 2^6 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0$$

\Rightarrow *The binary number is 10011011110_2*

2) Convert 101010_2 to base ten number

$$101010_2$$

$$1 \cdot 2^5 + 0 \cdot 2^4 + 1 \cdot 2^3 + 0 \cdot 2^2 + 1 \cdot 2^1 + 0 \cdot 2^0$$

$$32 + 0 + 16 + 0 + 2$$

$$50$$

3) Write prime factorization of 240 in canonical form

$$240$$

$$24 \cdot 10$$

$$4 \cdot 6 \cdot 2 \cdot 5$$

$$2 \cdot 2 \cdot 2 \cdot 3 \cdot 2 \cdot 5$$

$$2^4 \cdot 3 \cdot 5 \text{ Canonical form}$$

Key things to remember about numbers unit

- 1) Binary numbers
- 2) Base Ten Numbers
- 3) Prime Factorization
- 4) Prime Numbers
- 5) Rational and Irrational Numbers

Pythagorean Theorem

4)

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

$$13^2 = 12^2 + b^2$$

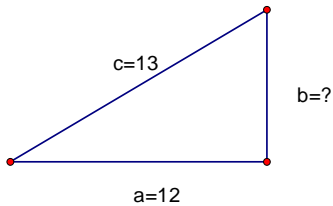
$$169 = 144 + b^2$$

$$169 - 144 = b^2$$

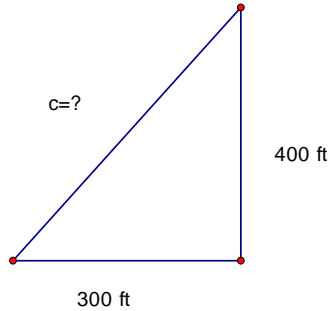
$$25 = b^2$$

$$\sqrt{25} = \sqrt{b^2}$$

$$b = 5$$



- 6) An empty lot is 300 feet by 400 feet. How much distance would you save walking diagonally across the lot instead of length and width?



$$c^2 = 300^2 + 400^2$$

$$c^2 = 90000 + 160000$$

$$c^2 = 250000$$

$$\sqrt{c^2} = \sqrt{250000}$$

$$c = 500 \text{ feet}$$

you would save 700 feet – 500 feet = 200 feet

Know how to tell if a triangle $\triangle ABC$ is right, obtuse, or acute

$c^2 < a^2 + b^2 \Rightarrow \triangle ABC$ is an acute triangle

$c^2 > a^2 + b^2 \Rightarrow \triangle ABC$ is an obtuse triangle

$c^2 = a^2 + b^2 \Rightarrow \triangle ABC$ is a right triangle

Solutions to the study guide

Math 116

Test 1 Review

1) Convert 1246 to a binary number

$$\text{Answer: } 1246 = 2^{10} + 2^7 + 2^6 + 2^4 + 2^3 + 2^2 + 2^1 \Rightarrow 1001101111_2$$

2) Convert 124 to a binary number

$$\text{Answer: } 124 = 2^6 + 2^5 + 2^4 + 2^3 + 2^2 \Rightarrow 1111100_2$$

3) Convert 100110_2 to a base ten number

Answer:

$$100110_2$$

$$1 \cdot 2^5 + 0 \cdot 2^4 + 0 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^1 + 0 \cdot 2^0 = 32 + 0 + 0 + 4 + 2 + 0 = 38$$

4) Convert 10101_2 to a base ten number

Answer:

$$10101_2$$

$$1 \cdot 2^4 + 0 \cdot 2^3 + 1 \cdot 2^2 + 0 \cdot 2^1 + 1 \cdot 2^0 = 16 + 4 + 1 = 21$$

5) Write the prime factorization of 445

$$\text{Answer: } 445 = 89 \cdot 5$$

6) Write the prime factorization of 640

Answer:

$$640$$

$$64 \cdot 10$$

$$8 \cdot 8 \cdot 2 \cdot 5$$

$$2 \cdot 4 \cdot 2 \cdot 4 \cdot 2 \cdot 5$$

$$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5$$

$$2^7 \cdot 5$$

7) Which of the following number are prime
40, 57, 111, 223, 411

223 is prime

8) Identify each number as a rational number or irrational number

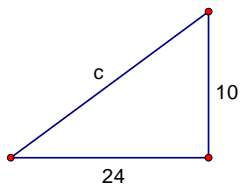
$-10, 5, e, \pi, \sqrt{3}, \frac{4}{7}$

irrational numbers : $e, \pi, \sqrt{3}$

rational numbers : $-10, 5, \frac{4}{7}$

8) Find the missing side of each right triangle.

a)



$$c^2 = 10^2 + 24^2$$

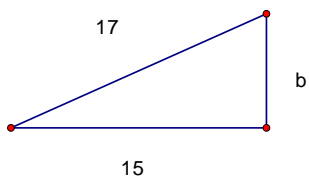
$$c^2 = 100 + 576$$

$$c^2 = 676$$

$$\sqrt{c^2} = \sqrt{676}$$

$$c = 26$$

b)



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

$$17^2 = 15^2 + b^2$$

$$289 = 225 + b^2$$

$$289 - 225 = b^2$$

$$64 = b^2$$

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

$$b = 8$$

9) Given that $\triangle ABC$ is a right triangle with hypotenuse c , find the missing side.

a) $a = 30$, $b = 40$, find c

$$c^2 = 30^2 + 40^2$$

$$c^2 = 900 + 1600$$

$$c^2 = 2500$$

$$\sqrt{c^2} = \sqrt{2500}$$

$$c = 50$$

b) $a = 10$, $c = 20$, find b

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

$$20^2 = 10^2 + b^2$$

$$400 = 100 + b^2$$

$$400 - 100 = b^2$$

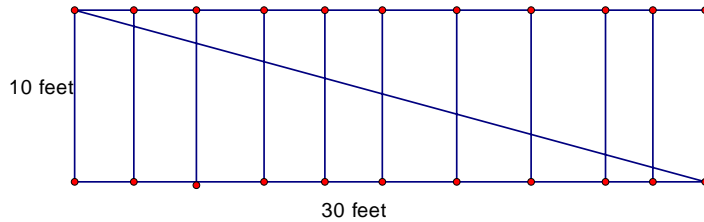
$$300 = b^2$$

$$\sqrt{300} = \sqrt{b^2}$$

$$b = \sqrt{300} = 17.3$$

Reading Problems

10) A diagonal brace is to be placed in the wall of a room. The height of the wall is 10 feet and the wall is 30 feet long. What is the length of the brace?



$$c^2 = 10^2 + 30^2$$

$$c^2 = 100 + 900$$

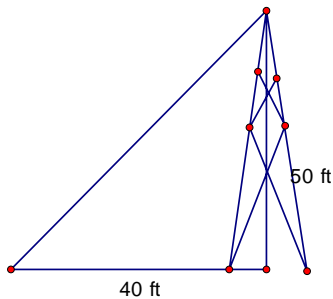
$$c^2 = 1000$$

$$\sqrt{c^2} = \sqrt{1000}$$

$$c = 31.6 \text{ feet}$$

11)

A television antenna is to be erected and held by guy wires. If the guy wires are 40 ft from the base of the antenna and the antenna is 50 ft high, what is the length of each guy wire?



$$c^2 = 50^2 + 40^2$$

$$c^2 = 2500 + 1600$$

$$c^2 = 4100$$

$$\sqrt{c^2} = \sqrt{4100}$$

$$c = 64 \text{ feet}$$

12) Determine if the triangle is an obtuse triangle, acute triangle, or right triangle.

a) 6,7,7

Answer: Acute

b) 9,12,15

Answer: Right

c) 5,6,10

Answer: Obtuse