

**Practice Final
Math 116**

Prime numbers and irrationals

1) Which number is a prime number?

- a) 220
- b) 111
- c) 71
- d) 135

Solution c) 71

2) Write the prime factorization of 120 in conical form.

- a) $2 \cdot 3^2 5$
- b) $2^2 3^2 5$
- c) $2 \cdot 3 \cdot 4 \cdot 5$
- d) $2^3 \cdot 3 \cdot 5$

Solution: d)

$$120$$

$$12 \cdot 10$$

$$3 \cdot 4 \cdot 2 \cdot 5$$

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

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

3) Write the prime factorization of 96 in conical form.

- a) $2 \cdot 3^5$
- b) $2^3 \cdot 3^3$
- c) $2^3 3^2$
- d) $3 \cdot 2^5$

Solution d)

96

$3 \cdot 32$

$3 \cdot 2 \cdot 16$

$3 \cdot 2 \cdot 2 \cdot 8$

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

$3 \cdot 2^5$

4) Convert the following binary number to a base ten number.

10110_2

- a) 22
- b) 24
- c) 30
- d) 36

Solution: a

$$10110_2 = 1 \cdot 2^4 + 0 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^1 + 0 \cdot 2^0 = 16 + 0 + 4 + 2 + 0 = 22$$

5) Convert 184 to a binary number.

- a) 1111000_2
- b) 10111000_2
- c) 11100100_2
- d) 11100_2

Solution: b

$$184 = 128 + 56$$

$$184 = 2^7 + 32 + 24$$

$$184 = 2^7 + 2^5 + 16 + 8$$

$$184 = 2^7 + 2^5 + 2^4 + 2^3$$

$$184 = 1 \cdot 2^7 + 0 \cdot 2^6 + 1 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 0 \cdot 2^2 + 0 \cdot 2^1 + 0 \cdot 2^0$$

answer : 10111000_2

6) Convert 19 to a binary number

- a) 11100_2
- b) 10011_2
- c) 11100_2
- d) 101100_2

Solution: b

$$19 = 16 + 3 = 16 + 2 + 1 = 2^4 + 2^1 + 2^0$$

$$10011_2$$

7) Chose the number that is rational.

- a) $\sqrt{2}$
- b) $\sqrt{81}$
- c) $\sqrt{19}$
- d) 4π

Solution: $\sqrt{81} = 9$ b

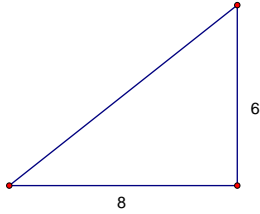
8) Chose the number that is irrational.

- a) $\sqrt{4}$
- b) $\sqrt{64}$
- c) $\frac{3}{5}$
- d) $\sqrt{11}$

Solution: d

Geometry

- 9) If a carpenter wants to make sure that a corner of a room is square and measures out 6 ft and 8 ft along the walls. How long should he make the diagonal?



- a) 12 ft
- b) 14 ft
- c) 10 ft
- d) 9 ft

Solution: c

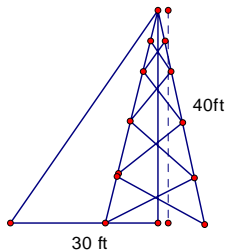
$$c^2 = 6^2 + 8^2$$

$$c^2 = 36 + 64$$

$$c^2 = 100$$

$$c = 10$$

- 10) A television antenna is to be erected and held by guy wires. If the guy wires are 30 ft from the base of the antenna and the antenna is 40 ft high, what is the length of each guy wire?



- a) 60 ft
- b) 70 ft
- c) 50 ft
- d) 45 ft

Solution:

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

$$c^2 = 900 + 1600$$

$$c^2 = 2500$$

$$c = 50$$

Logic

11) Which of the following is NOT a statement?

- a) Violets are blue
- b) Hokie Hokie Hi Tech Tech VPI
- c) Math 116 is one really cool class
- d) The sky is blue

Solution: b

12) Which of the following is NOT a statement?

- a) David Letterman comes on at 11:30
- b) Welcome to the friendly confines of Wrigley Field
- c) Elephants are a pink.
- d) $3+4=7$

Solution: b)

13) Negate the statement: Some students do not like Math 116

- a) Some students like Math 116
- b) All students like Math 116
- c) All student do not like Math 116
- d) None of the above

Solution: b)

14) Complete the following truth table for $(P \rightarrow \sim Q) \wedge Q$. Determine if the argument is a tautology?

P	Q	$\sim Q$	$(P \rightarrow \sim Q)$	$(P \rightarrow \sim Q) \wedge Q$
T	T	F	F	F
T	F	T	T	F
F	T	F	T	T
F	F	T	T	F

The argument is a not tautology.

15) Complete a truth table for $(\sim P \rightarrow \sim Q)$

Solution

P	Q	$\sim P$	$\sim Q$	$(\sim P \rightarrow \sim Q)$
T	T	F	F	T
T	F	F	T	T
F	T	T	F	F
F	F	T	T	T

16) Consider the following argument.

John notices that his first class in 295 Walker Hall is a technology classroom.
John notices that his second class in 205 Young Hall is also a technology classroom.
John notices that his last class in 405 Young Hall is also a technology classroom.
John concludes that all of classroom on campus are technology classroom.

- a) deductive reasoning
- b) inductive reasoning

Solution: b

17) Let $p =$ "John has a dollar bill" and $q =$ "Jane has a dollar bill" Which of the following is symbolized by $p \vee \sim q$.

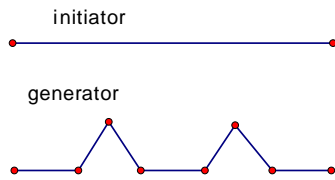
- a) It is not true that John has a dollar and Jane has a dollar.
- b) Either John does not have a dollar, or Jane does have a dollar.
- c) John has a dollar, but Jane does not.
- d) Either Jane has a dollar or Jane does not have a dollar

Solution: c) John has a dollar, but Jane does not.

18) Of the equations listed below, which has a graph that is a parabola opening up?

- a) $y = 2 - 3x$
- b) $y = 3x^2 - 2$
- c) $y = 3x - 2$
- d) $y = 2 - 3x^2$

19) Find the dimension of the given fractal.



$$N = 7$$

$$r = \frac{1}{5}$$

$$d = \frac{\log(7)}{\log\left(\frac{1}{\frac{1}{5}}\right)} = \frac{\log(7)}{\log(5)} = \frac{.8451}{.6990} = 1.2$$

20) The vertex of the parabola $y = 8x - 2x^2$

- a) (2,8)
- b) (2,-8)
- c) (-2,-8)
- d) (-2,4)

$$y = 8x - 2x^2$$

$$a = -2$$

$$b = 8$$

$$x = -\frac{b}{2a} = -\frac{8}{2(-2)} = -\frac{8}{-4} = 2$$

$$y = 8(2) - 2(2)^2 = 16 - 8 = -8$$

$$(2, -8)$$

Solution: b)

21) Suppose that a kicked football follows a path given by $y = -0.1x^2 + 1.6x$, where x is the distance in feet where the ball is kicked and y is the height of the ball above the ground. What is the maximum height the ball reaches?

- a) 6.4 feet
- b) 8 feet
- c) 64 feet
- d) 1.7 feet

Solution: a)

$$y = -0.1x^2 + 1.6x$$

$$a = -0.1$$

$$b = 1.6$$

$$x = -\frac{b}{2a} = -\frac{1.6}{2(-0.1)} = -\frac{1.6}{-0.2} = 8$$

$$y = -0.1(8)^2 + 1.6(8) = -6.4 + 12.8 = 6.4 \text{ feet}$$

22) A salesperson is paid \$100 plus \$70 per sale each week. The model $S = 70x + 100$ is used to calculate the salesperson's weekly salary where x is the number of sales per week.

- a. Use the model to calculate the salesperson's weekly salary if he/she makes 20 sales.

$$S = 70(20) + 100 = 1400 + 100 = \$1500.00$$

- b. What is the slope of the equation

$$m = 70 \frac{\$}{\text{sale}}$$

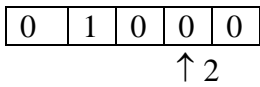
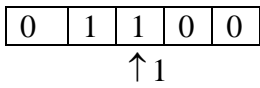
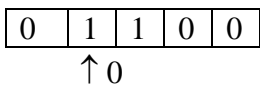
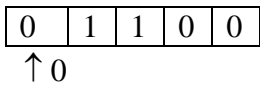
- c. What is the meaning of the slope

Dollars per each sale

23) What is the output of the following Turing machine using the input 0110?

$(0,0) \rightarrow (0,0, R)$
$(0,1) \rightarrow (1,1, R)$
$(1,1) \rightarrow (2,0, R)$
$(2,1) \rightarrow (1,1, R)$
$(1,0) \rightarrow (1,0, HALT)$
$(2,0) \rightarrow (2,0, HALT)$

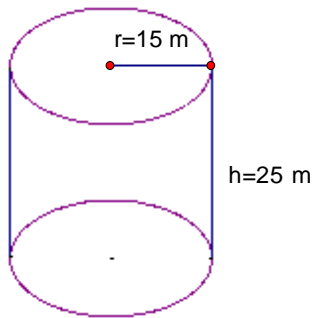
- a) 0110
- b) 0100
- c) 0111
- d) 0001



Output: 0100

Solution: b

24) A cylinder shaped city water tower has a height of 25 meters and a radius of 15 meters. How much water can this tower hold?



- a) $16000 m^3$
- b) $17662.5 m^3$
- c) $11234 m^3$
- d) None of the above

Solution: b

$$V = \pi r^2 h$$

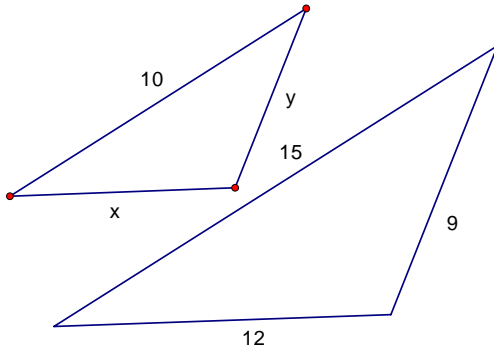
$$V = (3.14)(15)^2(25)$$

$$V = (3.14)(225)(25)$$

$$V = (706.5)(25)$$

$$V = 17662.5 m^3$$

25)



$$\frac{y}{9} = \frac{10}{15}$$

$$15 \cdot y = 9 \cdot 10$$

$$15y = 90$$

$$\frac{15y}{15} = \frac{90}{15}$$

$$y = 6$$

$$\frac{x}{12} = \frac{10}{15}$$

$$15 \cdot x = 12 \cdot 10$$

$$15x = 120$$

$$\frac{15x}{15} = \frac{120}{15}$$

$$x = 8$$

26)

The initial population of 20 mice is growing at a rate of 11% per month. How many mice will there be in 10 months if the mouse population is modeled by $P = P_0e^{rt}$

$$P = P_0e^{rt}$$

$$P = 20e^{-11(10)}$$

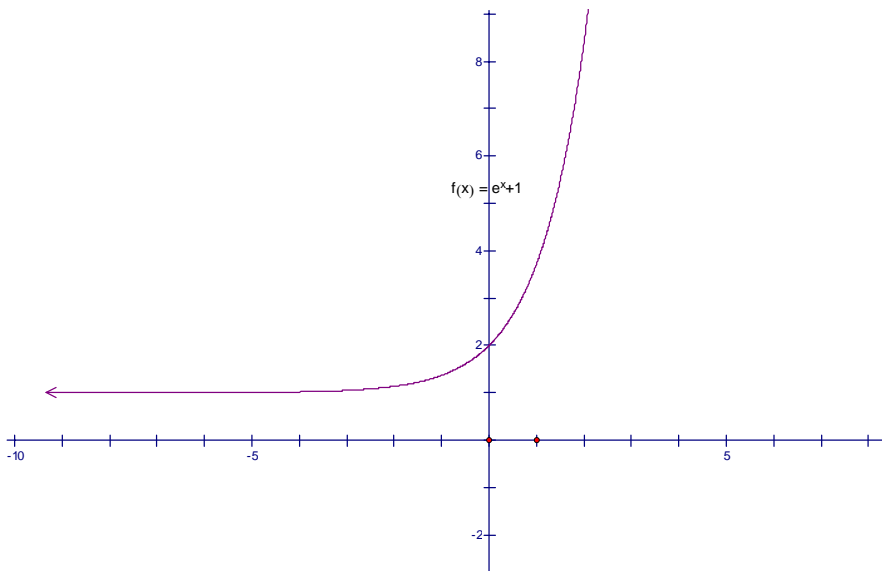
$$P = 20e^{1.1}$$

$$P = 20(3.00417)$$

$$P = 60 \text{ mice}$$

27) Graph $y = e^x + 1$

x	y
0	$y = e^0 + 1 = 1 + 1 = 2$
1	$y = e^1 + 1 = 2.7 + 1 = 3.7$
2	$y = e^2 + 1 = 7.4 + 1 = 8.4$
3	$y = e^3 + 1 = 20.1 + 1 = 21.1$



28) Which set is a proper subset of the set $\{a, b, c, d\}$

a) $\{a, b, c, d, e\}$

b) $\{a, b, c, d\}$

c) $\{a, c\}$

d) $\{a, e\}$

Solution: c

29) Which of the following sets is not well-defined?

a) $\{x \mid x \text{ is a dog that weighs at least 40 pounds}\}$

b) $\{x \mid x \text{ is dog that is at 25 inches in height}\}$

c) $\{x \mid x \text{ is a dog}\}$

d) $\{x \mid x \text{ is a large dog}\}$

Solution: d

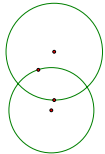
30) Let $A = \{1, 2, 3, 4, 5, 6\}$, $B = \{4, 5, 6, 7, 8\}$, and $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ where U is the universal set. Find $A \cap B$ and $A \cup B$.

$$A \cap B = \{4, 5, 6\}$$

$$A \cup B = \{1, 2, 3, 4, 5, 6, 7, 8\}$$

30) Which object is a simple closed curve?

a)



b)



c)



d)

