1. The numeral in the binary system for a certain integer is 10010110. In the base six system, the numeral for this number is:
   a) 401
   b) 4001
   c) 413
   d) 410
   e) 140

2. Alice and Barbara have the same birthday today. Alice will be twice Barbara’s age on their next birthday, a year from now. Alice was three times Barbara’s age five years ago on their birthday. How old is Alice today?
   a) 15
   b) 19
   c) 11
   d) 9
   e) 23

3. A set of forty numbers has an average of 75. Ten numbers are discarded from the set so that the remaining thirty numbers average 85. The average of the ten discarded numbers is:
   a) 55
   b) 80
   c) 45
   d) 65
   e) 50
4. In the decimal representation of the fraction \( \frac{3}{13} \), the 105\(^{th}\) decimal place to the right of the decimal point has the decimal digit?
   
   a) 6  
   b) 3  
   c) 2  
   d) 0  
   e) 9

5. The area of a circle is 36\(\pi\) square inches. The area of any inscribed square is:
   
   a) 18 in\(^2\)  
   b) 18\(\pi\) in\(^2\)  
   c) 36 in\(^2\)  
   d) 72 in\(^2\)  
   e) 24 in\(^2\)

6. In how many ways can 7 distinct plates be placed in a row so that 1 specified plate is in the middle?
   
   a) 5040  
   b) 49  
   c) 7  
   d) 720  
   e) 120
7. The right triangle ABC has an area equal to 10. If leg BC has length 5, find the length of the altitude BD.

a) \frac{20}{\sqrt{29}}

b) \frac{20}{\sqrt{41}}

c) \frac{7}{2}

d) \frac{3}{8}

e) none of the above

8. The angle X is ?

a) 100°

b) 05°

c) 120°

d) 110°

e) 115°

9. What is the distance X from the center to the base of an equilateral triangle with sides equal to 1 foot?

a) \sqrt{3} feet

b) 3 feet

c) \sqrt{2} feet

d) \frac{1}{2\sqrt{3}} feet

e) 2\sqrt{2} feet
10. What is the area of the largest circle that can be inscribed in a square of side 1?

a) $\frac{\pi}{3}$

b) 2

c) $\pi$

d) $\frac{\sqrt{2}}{2}$

e) $\frac{\pi}{4}$

11. If the circumference of a circle is equal to the perimeter of a square, then the ratio of the area of the square to the area of the circle is:

a) $4\pi$

b) $\frac{\pi}{2}$

c) $\frac{4}{\pi}$

d) $\frac{\pi}{4}$

e) 4

12. In a circle a central angle of 75° subtends an arc length of 15 inches. The radius of the circle is:

a) $\frac{36}{\pi}$ inches

b) 11.5 inches

c) $\frac{\pi}{36}$ inches

d) $\frac{1}{5}$ inches

e) $36\pi$ inches
13. This big cube is built of one inch cubes. How many of the one inch cubes have, at most, two faces on the outside surface of the big cube?

a) 19
b) 16
c) 17
d) 20
e) 18

14. What is the area of the shaded figure inside the rectangle?

a) 8
b) 54
c) 60
d) 72
e) 80

15. One plane flies at a ground speed 75 miles per hour faster than another. On a particular flight, the faster plane requires 3 hours and the slower one 3 hours and 36 minutes. What is the distance of the flight?

a) 450 miles
b) 375 miles
c) 1,000 miles
d) 1,450 miles
e) 1,350 miles
16. How many zeros appear at the end of $20!$ \quad (20! = 20 \cdot 19 \cdot 18 \cdot \ldots \cdot 3 \cdot 2 \cdot 1)

a) 6 

b) 3 

c) 5 

d) 4 

e) 2 

17. The solution set for \quad \frac{x^2 - 5x + 6}{x - 2} > 0 \quad is:

a) \{x \mid x < 3\} 

b) \{x \mid x > 3\} 

c) \{x \mid -2 < x < 3\} 

d) \{x \mid 2 < x < 3\} 

e) \{x \mid 2 < x < 3 \quad or \quad x < -2\} 

18. The fraction \quad \frac{m^{-1}}{m^{-1} + n^{-1}} \quad is equal to:

a) m 

b) \frac{m}{m + n} 

c) \frac{m + n}{m} 

d) \frac{m + n}{m - n} 

e) \frac{n}{m + n}
19. What is the last digit of $2^{2000}$?

a) 0  
b) 2  
c) 4  
d) 6  
e) 8

20. For the figure below, which of the following is true?

a) $4y + 5x = 2$  
b) $4x + 5y = 2$  
c) $x = y$  
d) $x^2 + y^2 = 25$  
e) None of the above

21. A fair coin is flipped. If it lands heads up, two dice are thrown. If it lands tails up, three dice are thrown. What is the probability that the sum of the numbers showing on the top faces of the dice is 4?

a) $\frac{5}{36}$  
b) $\frac{15}{144}$  
c) $\frac{5}{144}$  
d) $\frac{7}{144}$  
e) $\frac{7}{36}$
22.  If \( \log_8 3 = x \log_2 3 \) then \( x \) equals

a) 3

b) \( \log_4 3 \)

c) 4

d) \( \log_8 9 \)

e) \( \frac{1}{3} \)

23.  A fair coin is flipped 10 times. What is the probability that either two heads or two tails will appear in succession?

a) \( \frac{1}{2} \)

b) \( \frac{2}{3} \)

c) \( \frac{1}{512} \)

d) \( \frac{511}{512} \)

e) None of the above

24.  Two socks are drawn at random from a drawer containing 10 black socks and 10 white socks. What is the probability that they match?

a) \( \frac{1}{2} \)

b) \( \frac{9}{10} \)

c) \( \frac{8}{19} \)

d) \( \frac{11}{19} \)

e) None of the above
In 5 years John will be twice as old as Mary was 5 years ago. The sum of their ages is 30 years. How old is Mary?

a) 20
b) 15
c) 17
d) 12
e) 18