

10. What is the sum of the solutions to the equation

$$1 = \frac{6}{x} - \frac{8}{x(x+3)}?$$

- (1) -2 (2) 3
 (3) -4 (4) 5
 (5) None of the above

11. Which quadrant is the vertex of the parabola

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

in? (Using the standard horizontal x and vertical y axes?)

- (1) I (2) II
 (3) III (4) IV
 (5) None of the above

12. The average of four different real numbers is 6. Which of the following *must* be true?

1. Two of the numbers are less than 6 and two are greater than 6.
2. If the smallest number is zero, then none of the numbers is greater than 12.
3. At least one of the numbers is less than 6.

- (1) 3 only (2) 2 only
 (3) 2 and 3 only (4) 1, 2, and 3
 (5) None of the above

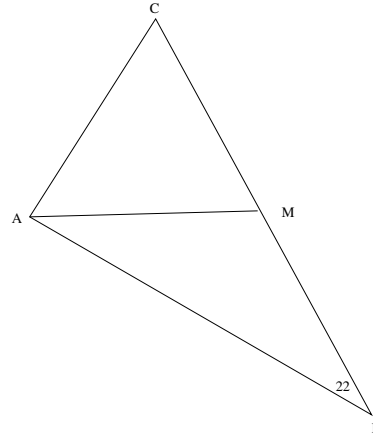
13. What is the remainder when $x + x^{25} + x^{81} + x^9 + x^{49}$ is divided by $-x + x^3$?

- (1) x^{27} (2) $x^2 + 5x + 1$
 (3) $5x^2$ (4) $5x$
 (5) None of the above

14. Which of the following numbers is irrational?

- (1) $\frac{22}{7}$ (2) 3.141592
 (3) 2.78181818... (4) .112123123412345...
 (5) None of the above

15. In pictured triangle ABC , there is a right angle at A . If the measure of the angle at B is 22 degrees, and if M is the midpoint of the side \overline{BC} , what is the measure of angle AMC , in degrees?



- (1) Can't be determined (2) 22
 (3) 33 (4) 44
 (5) None of the above

16. Two vertical telephone poles are 50 feet apart. One is 20 feet tall, while the other is 60 feet tall. A blue laser shines from the top of the shorter pole to the base of the taller pole, and a red laser shines from the top of the taller pole to the base of the shorter pole. What is the height of the point where the laser beams meet?

- (1) 15 (2) 18
 (3) 20 (4) 21
 (5) None of the above

17. What is the ones digit of the number $2^{201} + 3^{151}$?

- (1) 1 (2) 3
 (3) 6 (4) 7
 (5) None of the above

18. If

$$r = \frac{1}{\frac{2}{a} + \frac{3}{b}},$$

is solved for a in terms of b and r , then $a =$

- (1) $\frac{2br}{b-3r}$ (2) $\frac{2}{r} - \frac{2}{3}b$
 (3) $\frac{2b}{3br-1}$ (4) $\frac{2r}{3b-r}$
 (5) None of the above

- 19.** Mark is given a 5 minute head start in a 1 mile race with Tom. If Tom can run at a speed of 5 miles per hour and Mark at 3 miles per hour, who will win the race and by how much time?
- (1) Mark, by 3 minutes
 - (2) Tom, by 3 minutes
 - (3) Tom, by 8 minutes
 - (4) Tom, by 12 minutes
 - (5) None of the above
- 20.** If $1 - y$ is used as an approximation to the value of $\frac{1}{1+y}$ where $|y| < 1$, then the ratio of the error made to the correct value is
- (1) y
 - (2) y^2
 - (3) $\frac{1}{1+y}$
 - (4) $\frac{y^2}{1+y}$
 - (5) None of the above
- 21.** What is true about the intersection of the curves $y = \frac{x^2-16}{x-4}$ and $y = 2x$?
- (1) The x coordinate of the only intersection point is 4.
 - (2) There are more than two point in the intersection.
 - (3) There are no points in the intersection.
 - (4) The intersection consists of exactly two points.
 - (5) None of the above
- 22.** When Darby and Maddie leave their respective houses at the same time and walk toward each other, they meet in exactly 6 minutes. If Darby leaves after letting Maddie have a 3 minute head start, then they meet after Darby has walked for 4 minutes. How many minutes would it take Darby to walk from her house to Maddie's house?
- (1) 15
 - (2) 16
 - (3) 17
 - (4) 18
 - (5) None of the above
- 23.** Suppose that f and g are functions and that
- $$f(g(x)) = x + 2,$$
- and that
- $$f(s) = \frac{4-s}{s+1}.$$
- What is $g(t)$?
- (1) $g(t) = f(t) + 2$
 - (2) $g(t) = f(t) - 2$
 - (3) $g(t) = \frac{t+3}{2-t}$
 - (4) $g(t) = \frac{2-t}{t+3}$
 - (5) None of the above
- 24.** Find the sum of the coordinates of the midpoint of the line segment whose endpoints are the two intersection points of the curves
- $$x^2 - 6x + y^2 = -8,$$
- and
- $$y = x^2 - 4x + 4.$$
- (1) 1
 - (2) 2
 - (3) 3
 - (4) 4
 - (5) None of the above
- 25.** Suppose that 100 people were surveyed about their opinions related to three sports played in January, and the following results were noted: 12 people liked both football and hockey, 10 liked both football and basketball, and 7 liked both basketball and hockey. There were 77 people who didn't like any of these sports, and there wasn't anybody who liked exactly one of these sports. How many liked all three?
- (1) 1
 - (2) 2
 - (3) 3
 - (4) 4
 - (5) None of the above
- 26.** The 4-digit number $2abc$ is multiplied by 4 to get the 4-digit number $cba2$. What is $a + b$?
- (1) 5
 - (2) 6
 - (3) 7
 - (4) 8
 - (5) None of the above

27. The quadratic equation whose roots are reciprocals of the roots of

$$6x^2 - 11x + 4 = 0$$

is

- (1) $4x^2 - 11x + 6 = 0$ (2) $8x^2 - 10x + 3 = 0$
 (3) $4x^2 - 17x + 4 = 0$ (4) $\frac{1}{6}x^2 - \frac{1}{11}x + \frac{1}{9} = 0$
 (5) None of the above

28. At a certain party, everybody shakes hands with everybody else exactly once, although nobody (of course) shakes hands with themselves. If there were a total of 55 handshakes, how many people were at the party?

- (1) 10 (2) 11
 (3) 12 (4) 13
 (5) None of the above

29. What is the largest value of $|x^2 - 16|$ if x satisfies $|x - 4| \leq .3$?

- (1) 2.49 (2) 2.31
 (3) 2.16 (4) 5.34
 (5) None of the above

30. Doug eats $\frac{1}{3}$ of the M&M's which Mickey has "hidden" in the file cabinet. Then Tom sneaks in and eats $\frac{1}{3}$ of what's left. Realizing she'd better act quickly, Mickey then eats $\frac{1}{3}$ of what remains. When I go to check out the stash after that, I found that there are only 64 M&M's left. How many were there before Doug started eating?

- (1) 200 (2) 213
 (3) 219 (4) 221
 (5) None of the above

31. Bozo the monkey has a set of four colored cups, which each can hold no more than one ball. Careful observation of Bozo leads one to note the following:

1. If the red cup is empty, then the blue cup isn't empty.
2. If the blue cup is empty, then the green and yellow cups have the same number of balls in them.
3. If the green cup is empty, then the yellow cup isn't empty.

Suppose that you notice that the blue cup is empty. What is the sum of the number of balls in the four cups?

- (1) 0 (2) 1
 (3) 2 (4) 3
 (5) None of the above

32. If Tom can beat Kevin by $\frac{1}{10}$ of a mile in a two mile race, and Kevin can beat Mark by $\frac{1}{5}$ of a mile in a two mile race, then by how many miles would Tom beat Mark in a two mile race?

- (1) .3 (2) .29
 (3) .20 (4) .19
 (5) None of the above

Bonus Questions: Show all your work.

1. Generalize number 9 on this exam by finding the average score on the test over the set of all my students if my first class has n_1 students with class average of a_1 while my second class has n_2 students and a class average of a_2 .
2. Generalize number 15 on this exam by finding the height of the point where the laser beams meet if the first pole is a feet tall, the second pole is b feet tall, and the poles are c feet apart.