

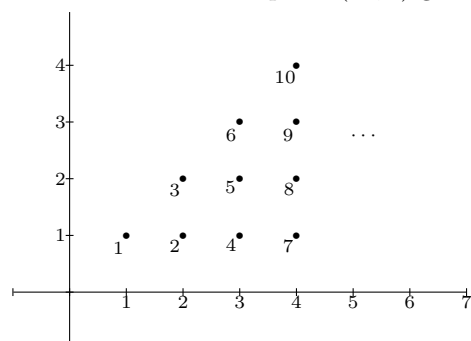
1. 42 increased by  $28\frac{4}{7}\%$  is the same as 35 increased by what percent?

- A.  $19\frac{4}{7}\%$       B.  $37\frac{1}{7}\%$       C.  $54\frac{2}{7}\%$       D.  $62\frac{4}{7}\%$       E.  $71\frac{5}{7}\%$

2. If  $x^3 - 3x^2 - x + 3 = (x - 3)f(x)$ , then what is  $f(x)$ ?

- A.  $(x + 1)^2$       B.  $(x - 1)^2$       C.  $(x - 1)(x + 1)$       D.  $(\frac{1}{2}x - 1)(x + 2)$       E.  $(\frac{1}{2}x + 1)(x - 2)$

3. What number is at the point (10, 7) given the pattern array below?



- A. 50  
B. 52  
C. 58  
D. 61  
E. 63

4.  $(2(1) - 1) + (2(2) - 1) + (2(3) - 1) + \dots + (2(99) - 1) =$

- A. 9751      B. 9801      C. 9901      D. 10010      E. 10201

5. A circle has center  $O$  and a point  $P$  on the circle. Point  $Q$  is outside the circle so that  $\overline{QP}$  is tangent to circle  $O$  and point  $R$  is on the circle, forming a secant  $\overline{QR}$ , intersecting the circle at  $T$  also, with  $QR > QT$ . If  $QP = 6$  and  $TR = 4$ , find  $TQ$ .

- A.  $2(\sqrt{10} - 1)$       B.  $2(\sqrt{17} - 3)$       C. 9      D. 4      E.  $\sqrt{13} + 2$

6. If  $x + 2y = 56$  and  $x - 3y = -24$ , then  $xy =$

- A. 484      B. 384      C. 396      D. 441      E. 323

7. If  $\log_b 6 = 2$ , then  $\log_{b/2} x = 4$ . Find  $x$ .

- A.  $(\frac{3}{2})^3$       B.  $(\frac{5}{2})^3$       C.  $(\frac{5}{2})^2$       D.  $(\frac{5}{4})^2$       E.  $(\frac{3}{2})^2$

8. The graph of  $y = 5 \tan\left(\frac{x}{b}\right) - 3$  has a period of  $\pi$ . Find  $b$ .

- A. 2      B.  $\frac{1}{2}$       C.  $\frac{1}{3}$       D. 1      E. 3

9. The volume of a box is  $200 \text{ in}^3$ . If the base of the box has area  $10 \text{ in}^2$ , find the total surface area of the box.

- A.  $120 \text{ in}^2$       B.  $60 \text{ in}^2$       C.  $75 \text{ in}^2$       D.  $160 \text{ in}^2$       E. not enough information

10. Identify the conic whose equation is  $y^2 - 2y - x - 4 = 0$ .
- A. ellipse      B. circle      C. parabola      D. hyperbola      E. two parallel lines
11. Let  $f(x) = \begin{cases} x^2 - 1, & \text{if } x \leq 0 \\ x - 1, & \text{if } 0 < x \leq 1 \\ x^2, & \text{if } x > 1 \end{cases}$ . On what interval(s) is  $f$  continuous?
- A.  $(-\infty, \infty)$     B.  $(0, 1)$     C.  $(-\infty, 0) \cup (0, \infty)$     D.  $(-\infty, 0) \cup (0, 1) \cup (1, \infty)$     E.  $(-\infty, 1) \cup (1, \infty)$
12. Find the positive difference between the median and the mode of 3, 9, 7, 6, 9, 5, 6, 7, 8, and 6.
- A.  $\frac{1}{2}$       B. 1      C.  $1\frac{1}{2}$       D. 2      E.  $2\frac{1}{2}$
13. Which property is demonstrated in the following equation?  $3(x^2 + 3x) = 3x^2 + 3(3x)$
- A. commutativity    B. closure    C. distributive    D. additive inverse    E. additive identity
14. Find the domain of the function  $g(x) = 3 \cos^{-1}(2x - 1)$ .
- A.  $[-1, 1]$       B.  $[0, 1]$       C.  $[0, 3]$       D.  $[-3, 3]$       E.  $[-\frac{1}{3}, \frac{1}{3}]$
15. If  $A$ ,  $B$ , and  $C$  are roots of the cubic function  $f(x) = x^3 - (A + 6)x^2 + (6A + 8)x + 8$ , then  $f(3) =$
- A. 16      B. -1      C. 8      D. -6      E. -4
16. A fair coin is flipped 6 times. Find the probability of getting at least 5 heads.
- A.  $7\left(\frac{1}{2}\right)^6$       B.  $6\left(\frac{1}{2}\right)^6$       C.  $5\left(\frac{1}{2}\right)^6$       D.  $4\left(\frac{1}{2}\right)^6$       E.  $3\left(\frac{1}{2}\right)^6$
17. An ant walks away from its colony due north at a constant speed of 3 feet per min. After two hours, it turns  $35^\circ$  towards the east and walks for 10 minutes (same speed). How long will it take him to get back to the colony using a direct route?
- A. 2.05 hr      B. 2.09 hr      C. 2.14 hr      D. 2.21 hr      E. 2.27 hr
18. Equilateral triangle  $ABC$  has medians  $M_A$ ,  $M_B$ , and  $M_C$ . Find the ratio of the sum of the lengths of the medians to the perimeter of the triangle.
- A. 1      B.  $\frac{\sqrt{3}}{2}$       C.  $\frac{\sqrt{3}}{3}$       D.  $\frac{1}{2}$       E.  $\frac{\sqrt{2}}{2}$
19. The equation of the normal line to  $f(x) = x^2 - 3x$  at  $(2, -2)$  is
- A.  $y = x - 4$       B.  $y = x + 4$       C.  $y = -x - 4$       D.  $y = -x$       E.  $y = x$
20. A rectangle has its base along the  $x$ -axis and is inscribed under the curve  $g(x) = 4 - x^4$ . Find the largest possible area of the rectangle.
- A. 5.26      B. 6.05      C. 7.28      D. 7.79      E. 8.41