

1. $\frac{1}{x+3} = x-3 \Rightarrow 1 = (x+3)(x-3) \Rightarrow 0 = x^2 - 10$ This has two solutions but only $\sqrt{10}$ is positive. The correct answer is **B**
2. $4x^2 + y^2 = 64 \Rightarrow \frac{x^2}{16} + \frac{y^2}{64} = 1$ Endpoints of the major axis are the vertices and they occur here on the y -axis since the y denominator is larger. They occur at $(0,8)$ and $(0,-8)$ The correct answer is **A**
3. $\frac{A}{B} = \frac{80}{100} \rightarrow \frac{B}{A} = \frac{100}{80} = 1.25 = 125\%$ The correct answer is **B**
4. $(1+i)^6 = 1 + 6i + 15i^2 + 20i^3 + 15i^4 + 6i^5 + i^6$
But, since $i = i^5$ and $i^2 = i^6 = -1$ and $i^3 = -i$ and $i^4 = 1$ we have, by repeated substitution $-8i$ The correct answer is **D**
5. $x + \frac{1}{x} = 5 \Rightarrow \left(x + \frac{1}{x}\right)^2 = 5^2 \Rightarrow x^2 + 2 + \frac{1}{x^2} = 25 \Rightarrow x^2 + \frac{1}{x^2} = 23$
The correct answer is **C**
6. I wash $\frac{1}{30}$ of the dishes per minute. My brother washes $\frac{1}{x}$ of the load per minute. I work for 20 minutes so I complete $\frac{20}{30}$ of the job. My brother works for 10 minutes completing $\frac{10}{x}$ of the job. $\frac{10}{x} + \frac{20}{30} = 1 \Rightarrow \frac{300 + 20x}{30x} = 1$
 $300 + 20x = 30x \Rightarrow 300 = 10x \Rightarrow 30 = x$
The correct answer is **C**
7. $\log_2 x + \log_2 (x-4) = 5 \Rightarrow \log_2 (x^2 - 4x) = 5$, so by the definition of the logarithm we now have
 $2^5 = x^2 - 4x \Rightarrow 0 = x^2 - 4x - 32 \Rightarrow 0 = (x-8)(x+4)$. Only one of the solutions, $x = 8$, is in the domain of the logarithm. The correct answer is **D**
8. $3^{x^2} \cdot 9^{-x} = \left(\frac{1}{27}\right)^{-16} \Rightarrow 3^{x^2} \cdot 3^{-2x} = 3^{48} \Rightarrow x^2 - 2x - 48 = 0 \Rightarrow x = 8, x = -6$
The sum of these roots is 2. The correct answer is **B**
9. $|5 - 2x| = 8 \Rightarrow 5 - 2x = 8, 5 - 2x = -8$
 $-2x = 3, -2x = -13 \Rightarrow x = \frac{-3}{2}, x = \frac{13}{2}$. The product of these roots is $\frac{-39}{4}$
The correct answer is **E**

10. The circle has radius of 10 inches which means that the inscribed square has a diagonal of 20 inches. In the square with side x we have the equation $x^2 + x^2 = 20^2 \Rightarrow x^2 = 200$, so the area of the square is 200 and the difference between the areas of the figures is $100\pi - 200$. The correct answer is **C**.
11. $0 = x^3 + 2x^2 - 3x - 6 \rightarrow 0 = x(x^2 + 2) - 3(x + 2) \rightarrow 0 = (x - 3)(x^2 + 2)$
This equation has one real solution. This equation has three complex solutions, so the product is 3. The correct answer is **C**.
12. Using synthetic division we can see that 1 is a root with the remaining equation $10x^2 - 7x - 12 = 0 \rightarrow (5x + 4)(2x - 3) = 0$. The sum of the three real roots we find is $\frac{5}{2}$. The correct answer is **D**.
13. $2 \leq |2x + 1| \rightarrow 2x + 1 \leq -2, 2 \leq 2x + 1 \rightarrow x \leq \frac{-3}{2}, \frac{1}{2} \leq x$
The correct answer is **A**.
14. $9x^2 - 18x + 4y^2 + 8y = 23 \Rightarrow 9(x^2 - 2x) + 4(y^2 + 2y) = 23$
 $9(x^2 - 2x + 1) + 4(y^2 + 2y + 1) = 23 + 9 + 4 \Rightarrow 9(x - 1)^2 + 4(y + 1)^2 = 36$
The center of this ellipse is the ordered pair $(1, -1)$. The correct answer is **C**.
15. This will be the third term of the expansion which will be ${}_5C_3 (2y)^3 (-3x)^2 = \frac{5!}{2!3!} (8y^3)(9x^2) = -720y^3x^2$. The correct answer is **A**.
16. Using our laws of logs we can rewrite $\log \frac{75}{8} = \log 75 - \log 8$. Since we know $\log 2 = A, \log 3 = B$ and $\log 5 = C$ rewrite the above expression as $\log 75 - \log 8 = \log (3 \cdot 5^2) - \log 2^3 = \log 3 + 2\log 5 - 3\log 2$.
Therefore $\log \frac{75}{8} = B + 2C - 3A$. The correct answer is **D**.
17. $x^3 - x^2 - 2x = 0 \rightarrow x(x^2 - x - 2) = 0 \rightarrow x(x - 2)(x + 1) = 0$
There are three real solutions to this equation. The correct answer is **D**.

$$18. \quad \frac{5}{x-3} < \frac{3}{1-x} \Rightarrow \frac{5}{x-3} - \frac{3}{1-x} < 0 \Rightarrow \frac{5}{x-3} + \frac{3}{x-1} < 0$$

$$\frac{5x-5+3x-9}{(x-3)(x-1)} < 0 \Rightarrow \frac{8x-14}{(x-3)(x-1)} < 0 \quad \text{The critical values (where the}$$

rational expression is equal to zero or is undefined) here are

$x = \frac{7}{4}, x = 3, x = 1$. The intervals where the original inequality is true are

$$(-\infty, 1) \cup \left(\frac{7}{4}, 3\right)$$

The correct answer is **C**

19. $R(x) = P(x)S(x)$. The price function is $P(x) = 0.5 + 0.05x$, the function describing the number of sales per month is

$S(x) = 26000 - 1000x$. The product yields the quadratic function for revenues of $R(x) = -50x^2 + 800x + 13000$. The maximum value for

this is at the vertex. The vertex occurs at $x = \frac{-b}{2a} = \frac{-800}{-100} = 8$. Eight price

increases result in a sales price of 90 cents. The correct answer is **D**

$$20. \quad P(X=9) + P(X=10) \Rightarrow 10 \left(\frac{1}{2}\right)^1 \left(\frac{1}{2}\right)^9 + \left(\frac{1}{2}\right)^{10} = \frac{11}{1024}$$

The correct answer is **D**

$$21. \quad y = (x-3)(x+3)(x+2) \rightarrow y = (x^2-9)(x+2) \rightarrow y = x^3 + 2x^2 - 9x - 18$$

The correct answer is **A**

$$22. \quad \begin{array}{rcl} N & +D & +Q = 74 \\ 5N & +10D & +25Q = 885 \end{array} \quad \text{Combining the first and third equations we}$$

$$N \quad \quad \quad +Q = D+4$$

$$\text{get } \begin{array}{rcl} N & +D & +Q = 74 \\ N & -D & +Q = 4 \end{array} \quad \text{Subtracting the second from the first we see that}$$

$D = 35$. Substituting to create a new two by two system we have $Q = 17$

The correct answer is **B**

23. The highest power of eight that is less than 324 is the second power, so our answer will be a three digit answer.

$$324 = 5 \times 8^2 + 0 \times 8^1 + 4 \times 8^0 = 504_8 \quad \text{The correct answer is A}$$

24.
$$f\left(x + \frac{1}{2}\right) = \frac{1}{x + \frac{1}{2} - 2} = \frac{1}{x - \frac{3}{2}} = \frac{1}{\frac{2x - 3}{2}} = \frac{2}{2x - 3}$$

$$\frac{\frac{2}{2x - 3} - \frac{1}{x - 2}}{\frac{1}{2}} = \frac{4}{2x - 3} - \frac{2}{x - 2} = \frac{4x - 8 - 4x + 6}{(2x - 3)(x - 2)}$$

$$= \frac{-2}{(2x - 3)(x - 2)}$$
 The correct answer is **C**
25. $x = \sqrt{42 + \sqrt{42 + \sqrt{42 + \sqrt{42 + \dots}}}} \Rightarrow x^2 = 42 + \sqrt{42 + \sqrt{42 + \sqrt{42 + \sqrt{42 + \dots}}}}$
 $x^2 = 42 + x \Rightarrow x^2 - x - 42 = 0$ There are two solutions, but only one satisfies the original equation $x = 7$ The correct answer is **B**
26. In this triangle we know that $a = 3$ and that $b + c = 10$. We also know that $a^2 + b^2 = c^2 \rightarrow a^2 = c^2 - b^2 \rightarrow a^2 = (c + b)(c - b)$ So from this, using our know values for a and for $c - b$ we see that $c + b = \frac{9}{10}$. Knowing both $c + b$ and $c - b$ we find that $b = 4\frac{11}{20}$. The correct answer is **A**
27. $\frac{(n + 1)!}{(n - 1)!} = 90 \Rightarrow \frac{(n + 1)(n)(n - 1)!}{(n - 1)!} = 90 \Rightarrow (n + 1)(n) = 90$
 So, we need two consecutive natural numbers whose product is 90. Therefore, $n = 9$ The correct answer is **B**
28. This is an ellipse with a horizontal major axis and $a = 6, c = 4$. Since $c^2 = a^2 - b^2$ we have $20 = b^2$ Since the ellipse is horizontal our final equation is $\frac{x^2}{36} + \frac{y^2}{20} = 1$ The correct answer is **C**
29.
$$\begin{aligned} x + 4y &= -5 & x + 4y &= -5 \\ 8x - y &= -7 & \Rightarrow 32x - 4y &= -28 \end{aligned}$$
 Adding these two equations together we see that $x = -1$. Substitution shows that $y = -1$. Their sum is -2 . The correct answer is **B**
30. $\frac{1}{\sqrt{(x - 5)^2}} = 8$, so we know the denominator is $\frac{1}{8}$, so $x - 5 = \pm \frac{1}{8}$. We have two solutions for this equation, $x = \frac{41}{8}$ or $x = \frac{39}{8}$ The correct answer is **C**