

Section 21

Set 1

1. If $2x - 3 = x + 2$ and $x - a = 2 - ax$, then $a = ?$

(A) $\frac{1}{2}$ (B) $-\frac{2}{3}$ (C) $-\frac{3}{4}$ (D) $-\frac{4}{5}$

3. Calculate $\left(1 + \frac{1}{2}\right) \times \left(1 + \frac{1}{3}\right) \times \left(1 + \frac{1}{4}\right) \times \cdots \times \left(1 + \frac{1}{100}\right) = ?$

(A) $\frac{111}{101}$ (B) $\frac{101}{111}$ (C) $\frac{101}{2}$ (D) $\frac{2}{101}$

4. Calculate $\frac{123}{100\,000\,000} \times \frac{1.08}{6 \times 10^{18}} = ?$

(A) 1.23×10^{-20} (B) $2\,214 \times 10^{-21}$ (C) 2.214×10^{-25} (D) 2.214×10^{-26}

5. Given $abc \neq 0$, $3ab = 4bc = 2ac$, $a + b + c = 72$, then $(a + 2) : (b - 1) : c = ?$

(A) 4:2:3 (B) 6:1:3 (C) 3:2:4 (D) 34:15:24

7. Assume $x^2 + px + q = (x - a)(x - b)$; if $p < 0$, $q > 0$, which of the following is correct?

(A) $a > 0$, $b > 0$ (B) $a > 0$, $b < 0$ (C) $a < 0$, $b > 0$ (D) $a < 0$, $b < 0$

8. Assume a, b, c are real non-negative numbers. If the line $ax + by + c = 0$ passes through the second quadrant, what quadrant does the point (ab, bc) lie?

(A) First Quadrant (B) Second Quadrant (C) Third Quadrant (D) Fourth Quadrant

10. If $2x^3 + 3x^2 - 7x + 5 = (ax + b)(x^2 + x + 1) + cx + d$, then $a + b + c + d = ?$

(A) 3 (B) -3 (C) 2 (D) -2

21. Xiao Ming uses $\frac{1}{3}$ of her money to buy 2 books, each of the same price and uses the remaining $\frac{1}{2}$ to buy 3 pens. If she has 200 Yuan remaining, how much does one book cost?

(A) 50 Yuan (B) 100 Yuan (C) 150 Yuan (D) 200 Yuan

23. In 2003, a mother was 16 times older than her daughter (16:1). In 2007, the mother was 6 times older than her daughter (6:1). What is the mother-daughter age ratio in 2011?

(A) 3:1 (B) 1:2 (C) 4:1 (D) 5:3

Set 2

1. Toy blocks, with length, width, height of 1cm, 2cm, 3cm are stacked to make a cube. If there are 5000 total blocks, how many blocks are used if the largest possible cube was made?
2. Triangles A, B, C, D have side lengths $\{5, 11, 12\}$, $\{5, 11, 13\}$, $\{5, 11, 14\}$, $\{5, 11, 15\}$. Which has the largest area and why?
3. Find the area enclosed by the lines $x - 2y + 4 = 0$, $2x - y - 4 = 0$ if $x \geq 0$, $y \geq 0$?
4. Xiao Sha and Xiao Fei run together on a circular track. Xiao Sha can run a full lap in 36s. Xiao Fei runs in the opposite direction and passes Xiao Sha in 12s. How long does it take Xiao Fei to run a full lap?
5. Xiao Sha leaves his house at approximately 10am. He notices on his watch that both the hour and minute hands are on top of each other. He returns home at approximately 7pm to see both hands on his watch on top of each other once again. How long did Xiao Sha leave his house?
9. If $\frac{x}{m} + \frac{y}{n} + \frac{z}{p} = 1$, $\frac{m}{x} + \frac{n}{y} + \frac{p}{z} = 0$, evaluate $\frac{x^2}{m^2} + \frac{y^2}{n^2} + \frac{z^2}{p^2}$.
13. If $x \in \mathbb{R}$, what is the last digit of $x = \left[\frac{\sqrt{(a-2)(|a|-1)} + \sqrt{(a-2)(1-|a|)}}{1 + \frac{1}{1-a}} + \frac{5a+1}{1-a} \right]^{1988}$?
14. Solve $\frac{3}{x} + \frac{1}{x-1} + \frac{4}{x-2} + \frac{4}{x-3} + \frac{1}{x-4} + \frac{3}{x-5} = 0$

Section 22

Set 2

2. In a school's admission exam, the ratio of male and female candidates is 8:15, the ratio of male and female candidates that pass is 2:3 and the ratio of male and female candidates that fail is 1:2. What percentage of male and female students pass? (Asking for separate percentages)
8. If $a^2 + 4a + 1 = 0$ and $\frac{a^4 + ma^2 + 1}{2a^3 + ma^2 + 2a} = 3$, find m .
10. If $a + x^2 = 1\,999$, $b + x^2 = 2\,000$, $c + x^2 = 2\,001$ and $abc = 24$, find $\frac{a}{bc} + \frac{b}{ca} + \frac{c}{ab} - \frac{1}{a} - \frac{1}{b} - \frac{1}{c}$.
12. Given that a triangle whose two angles add up to n° and the largest angle is 24° greater than the smallest angle, what is the maximum value n° can take? (i.e. $n^\circ \leq ?$)
15. Find all set of solutions $\{a, b, c\}$ satisfying $6(5a^2 + b^2) = 5c^2$ where $c \leq 20$? $a, b, c \in \mathbb{N}$.

Section 23

Set 2

1. Solve $\frac{1}{3 \times 1} + \frac{1}{4 \times 2} + \frac{1}{5 \times 3} + \dots + \frac{1}{1999 \times 1997} + \frac{1}{2000 \times 1998}$.
4. Simplify $\frac{1}{a-x} - \frac{1}{a+x} - \frac{2x}{a^2+x^2} - \frac{4x^3}{a^4+x^4} + \frac{8x^7}{x^8-a^8}$.

6. Given $\begin{cases} \frac{a}{x} = \frac{bc}{b+c} \\ \frac{b}{y} = \frac{ca}{c+a} \\ \frac{c}{z} = \frac{ab}{a+b} \end{cases}, \quad abc \neq 0, \text{ find } \frac{1}{x+1} + \frac{1}{y+1} + \frac{1}{z+1}.$

12. Choose 8 numbers from 2, 3, 4, 7, 10, 11, 12, 13, 15 to fill in the table such that each row and column have the same arithmetic mean. Explain why 8 cannot be used.

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