Mathlete Training Centre

2024 HXC S1

1. Let a, b be distinct real numbers, simplify:

$$(a-b) \times (b-a) \times (a-b) \div (b-a).$$

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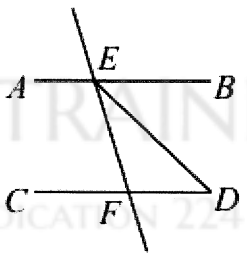
2. Referring to the accompanying diagram, given that $AB \parallel CD$, $\angle DEF = 20°$, and $\angle BED = 24°$, find the measure of $\angle EFD$ in degrees.



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3. If

$$\frac{2024 \times 106 + 7}{1354 + 506 \times 280} = \frac{a}{120},$$

find the value of a.

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4. There are four number cards, "2", "0", "2" and "4". How many non-negative integers can be formed?

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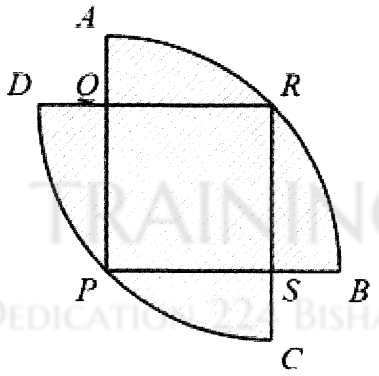
5. Referring to the figure below, two quarter-circle sectors $ARBP$ and $CPDR$ overlap each other. Given that $PQRS$ is a square. Find the area of the shaded region. (Take $\pi = 3.14$).



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6. Given that $a + b = 1$, $ab > 0$, and $c < -1$, simplify:

$$|-a-b| + |b+c-a| - |c-a| - |b-c|.$$

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7. From 1 to 2024 (including 1 and 2024), how many natural numbers are divisible by either 20 or 24?

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8. Given that x and y are real numbers,

$$2x - y = 12$$

and

$$5x + 2y = 21.$$

Find the value of $x + y$.

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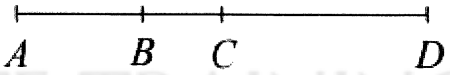
9. Referring to the figure below, given that

$$AB : CD = 7 : 11, \quad AC : BD = 121 : 169.$$

The length of AD is 2024 cm. What is the length of BC in cm?



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10. Solve the equation with one unknown:

$$\frac{2x+5}{x+1} = \frac{2x+6}{x+2}.$$

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Section B (Q11 - Q20) Each question is worth 7 marks

11. Find the value of

$$20^2 - 24^2 + 28^2 - 32^2 + \cdots + 92^2 - 96^2 + 100^2.$$

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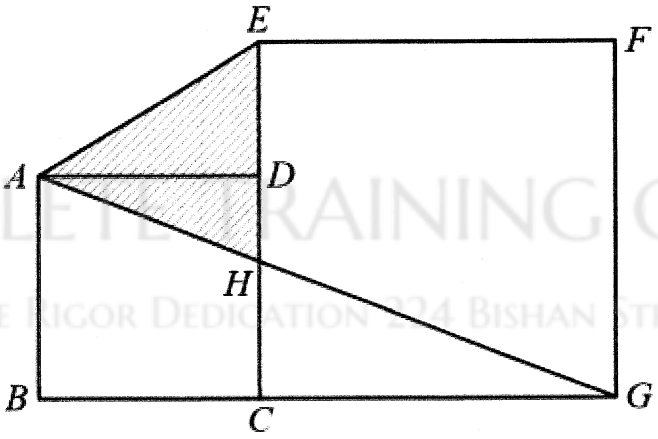
12. Referring to the figure below, BCG is a straight line. $ABCD$ and $CEFG$ are squares with side lengths 20 and 24 respectively. H is the point of intersection of AG and CD. Find the difference between the area of $\triangle AEH$ and the area of $\triangle CGH$



13. Given that 2024, 106, and 778 have the same remainder when divided by the positive integer n, find the maximum possible value of n.

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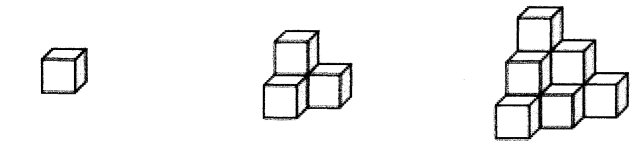
14. Referring to the figures below, Figure A is a unit cube (i.e., a cube with a side length of 1 unit). Figure B is composed of 4 unit cubes. Figure C is composed of 10 unit cubes, and so on. According to the pattern, in square units, what is the surface area of the solid figure composed of 220 unit cubes?



圖一
图一
Figure A

圖二
图二
Figure B

圖三
图三
Figure C

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15. Hua, Xia, and Bei start at the same time and place, chasing Chu, who is moving in the same direction along the same route. Hua, Xia, and Bei take 4, 6, and 12 minutes to catch up with Chu, respectively. Given that Hua and Xia walk 75 metres and 60 metres per minute, respectively, how many metres does Bei walk per minute?

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16. If

$$x^2 + x = 3$$

find the value of

$$x^3 - x^2 - 16x + 20 + 24.$$

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17. Find the sum of all possible positive value(s) of x satisfying the inequality

$$3x + 5 + \frac{1}{x-3} > 4x + \frac{4-x}{x-3}.$$

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18. Find the remainder when

$$2024^{2024}$$

is divided by 77.

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19. Let n be an integer. If

$$n^3 - 2n^2 - 8n + 7$$

is divisible by

$$2n + 3,$$

find the sum of all possible values of n.

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20. There are five integers. Two of them are the same. Taking four of them at a time and computing their sum gives four possible values: 106, 107, 108, and 109. What is the repeated number?

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