# International Online Math Challenge

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## PAST PAPERS 2023

### Category Kids

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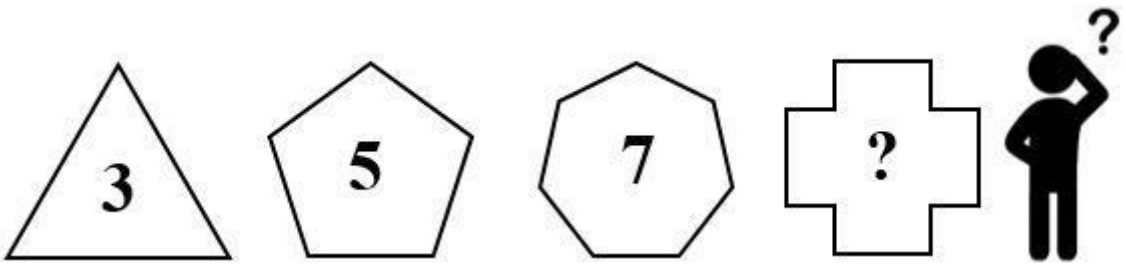
## Category Kids

1.



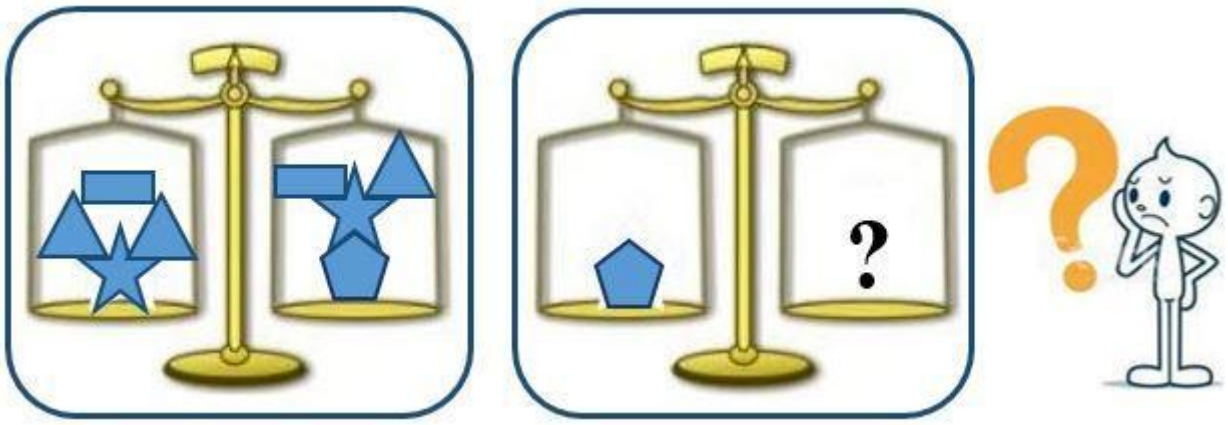

A) 07:40 B) 08:38 C) 08:20 D) 07:20

2.




A) 4 B) 11 C) 9 D) 12

3.



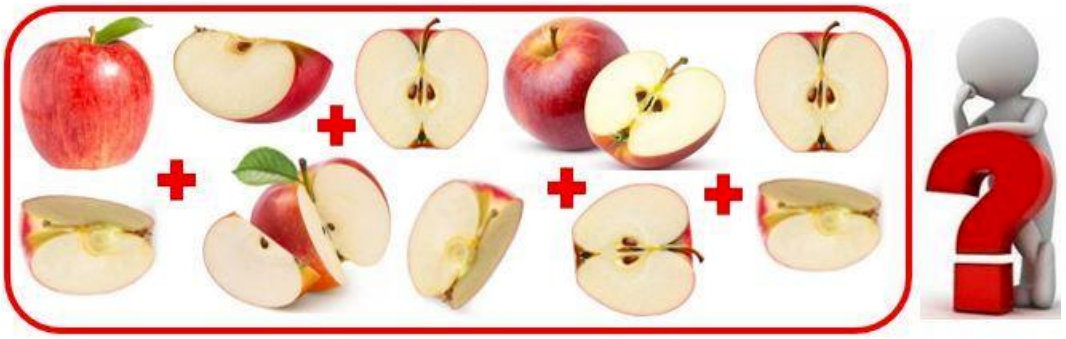

A)  B)  C)  D) 

4.



A) 09:30 B) 09:00 C) 04:30 D) 08:30

5.



A) 12 B) 6 C) 7 D) 2

6.



A) 188

B) 180

C) 88

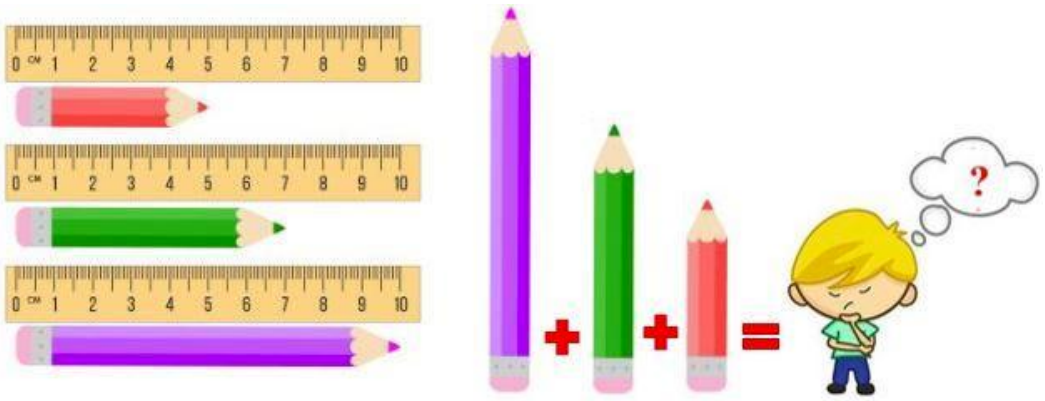
D) 7

7.



A) $10000 B) $1 C) $100 D) $9

8.

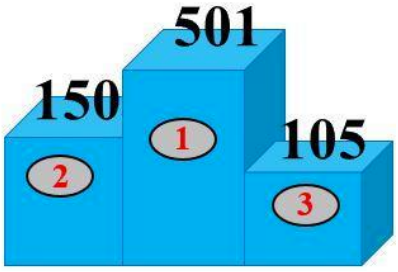


A) 22 cm B) 12 cm C) 10 cm D) 30 cm

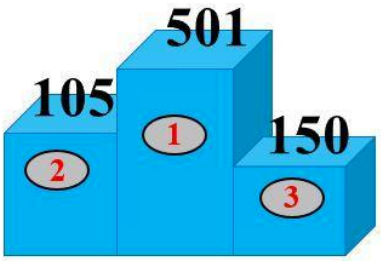
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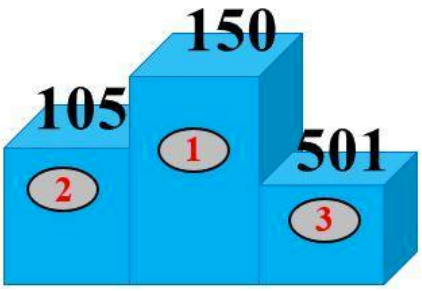
A)



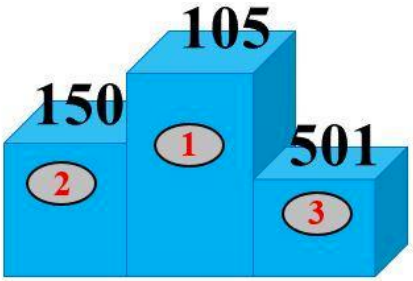

B)



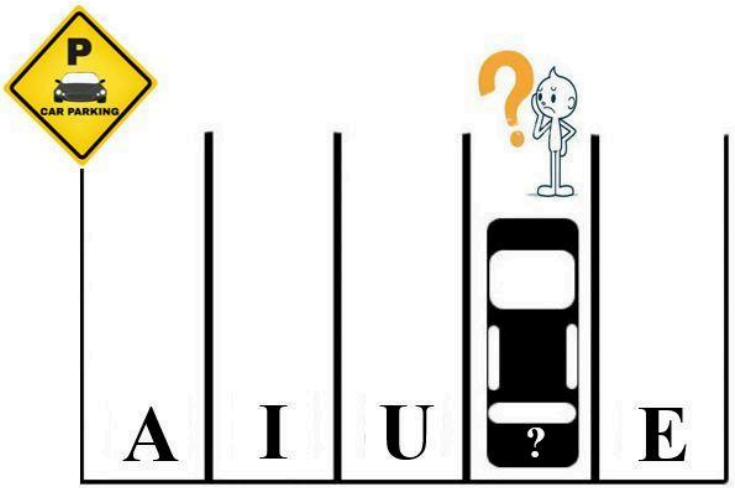

C)




D)

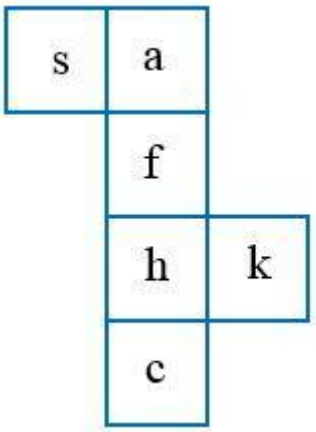


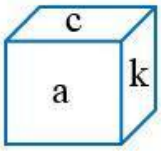

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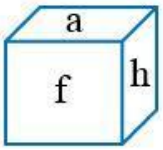


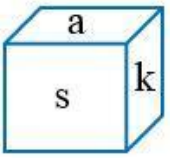

A) O B) D C) R D) C

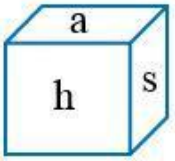
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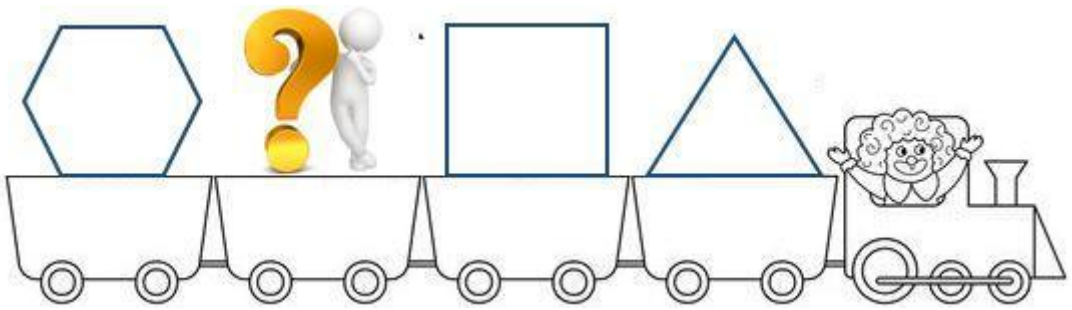

A) 


B) 


C) 


D) 


12.



A) 

B) 

C) 

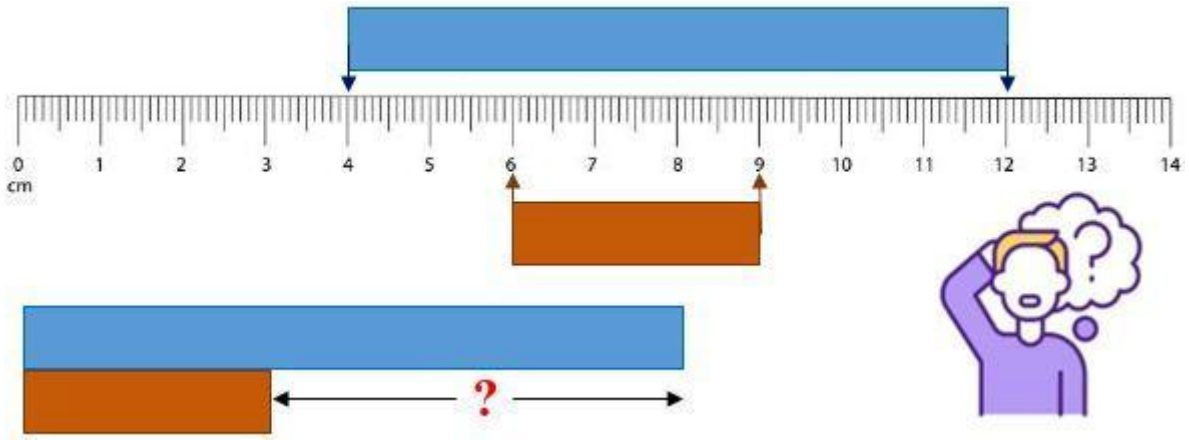
D) 

13.



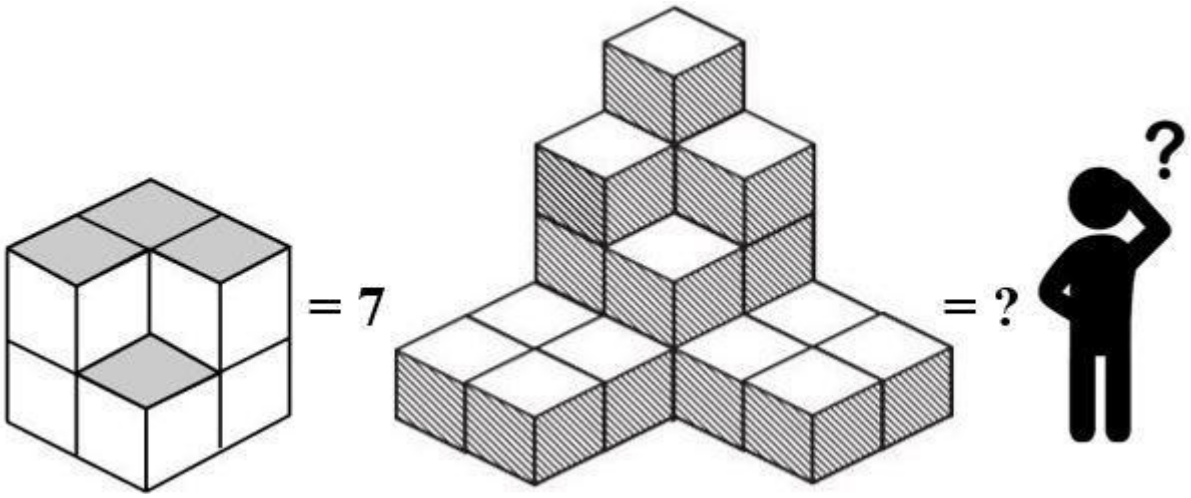

A) 55
B) 56
C) 44
D) 53

14.



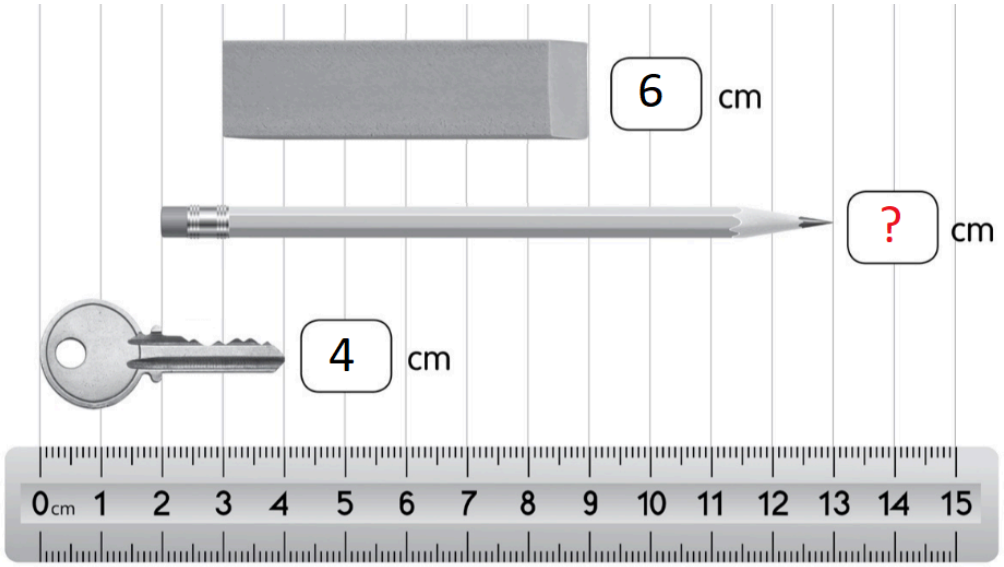

A) 6 cm B) 2 cm C) 3 cm D) 5 cm

15.



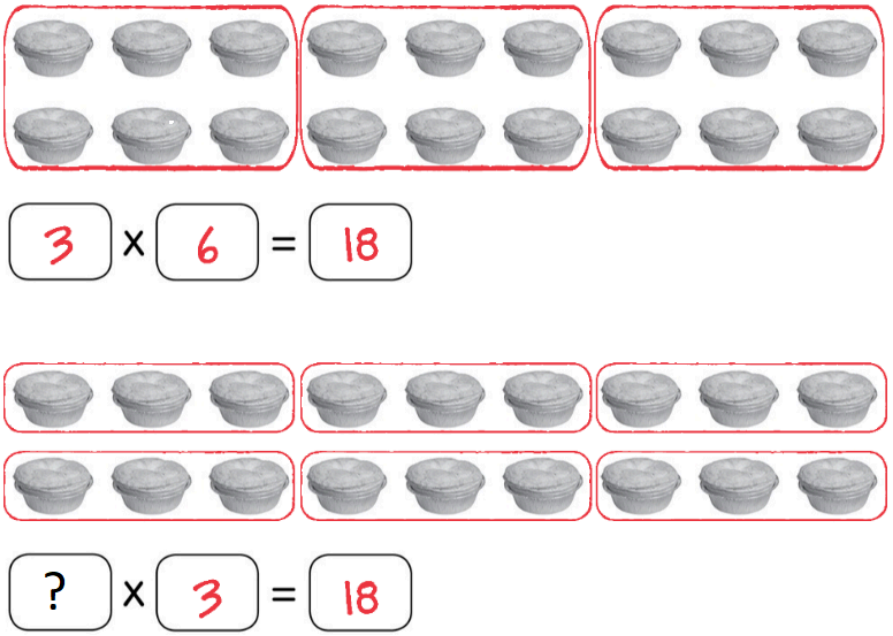

A) 20 B) 21 C)15 D) 16

16.



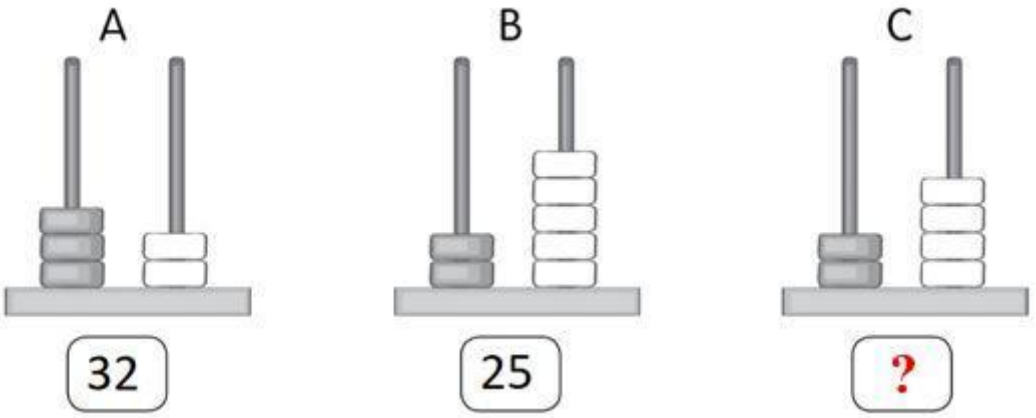

A) 8 B) 9 C)10 D) 11

17.




A) 8 B) 6 C)10 D) 4

18.



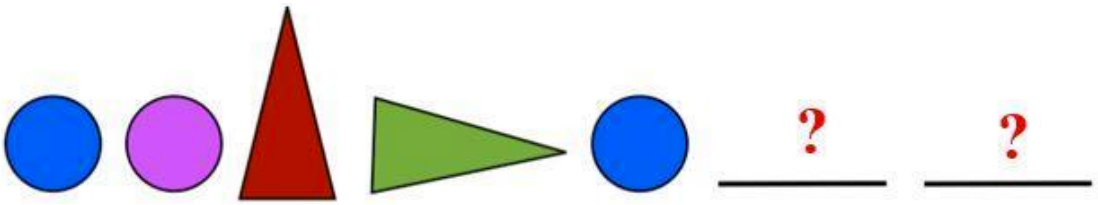

A) 23 B) 22 C) 24 D) 42

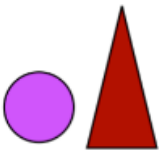
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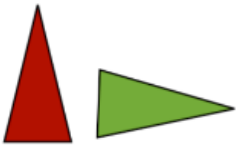



A) 27 B) 26 C) 29 D) 28

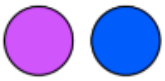
20.



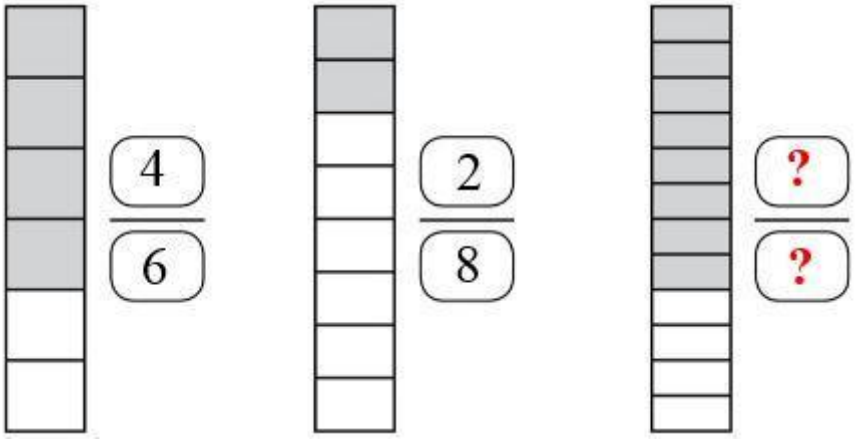

A) 

B) 

C) 

D) 

21.




A) $\frac{8}{10}$ B) $\frac{8}{12}$ C) $\frac{4}{16}$ D) $\frac{9}{12}$

22.




A) 17.12.23 B) 17.11.23 C) 11.11.23 D) 17.20.23

23.

| 12 | 14 | 16 | | | ? |
|---|---|---|---|---|---|

A) 20 B) 26 C) 22 D) 24

24.






A) 12:20 B) 04:12 C) 12:04 D) 16:00

25.

| 15 | 20 | | | ? | | | 50 |
|---|---|---|---|---|---|---|---|

A) 30 B) 35 C) 45 D) 40

# International Online Math Challenge

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### Category 1

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**EXAM 1**

1. Alex was born on Monday April 18, 2016, which is in a leap year. Which day of the week was his birthday two years later?

A) Monday B) Wednesday C) Sunday D) Friday

2. If one week equals 7 days, how many minutes are there in a week?

A) 10080 B) 10800 C) 1800 D) 18000

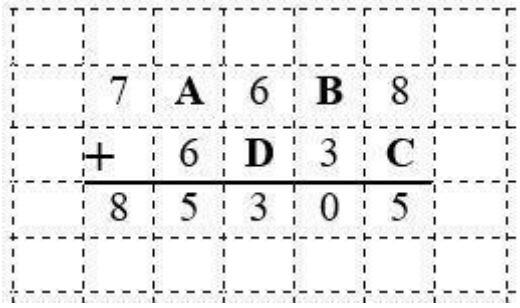
3. The cost of three pairs of trousers is $54. Jon buys seven pairs of trousers. How much does he pay?

A) $144 B) $108 C) $119 D) $126

4. James is ill. His doctor has given him eight pills, and James must take one pill every five hours. If James takes his first pill at 5 p.m. at what time will he takes his last pill?

A) 11 p.m. B) 4 a.m. C) 3 a.m. D) 8 a.m.

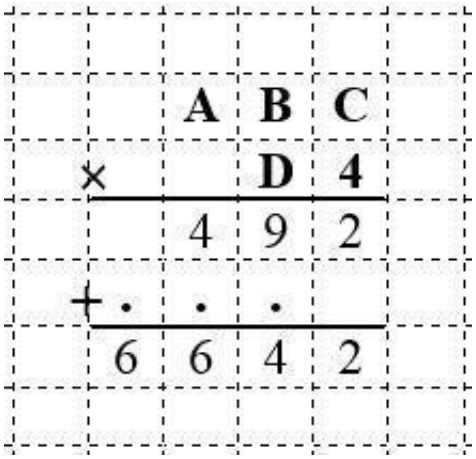
5. Find the sum of the **A+B+C+D**.



| | | | | | |
|---|---|---|---|---|---|
| | 7 | **A** | 6 | **B** | 8 |
| + | 6 | **D** | 3 | **C** | |
| 8 | 5 | 3 | 0 | 5 | |

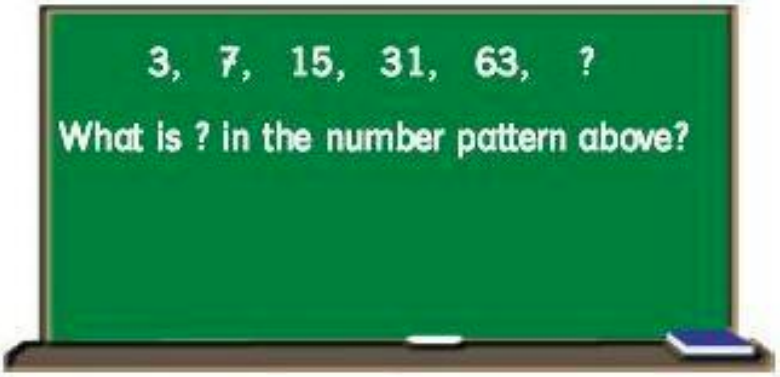
A) 15 B) 12 C) 27 D) 13

6. Find the sum of the **A+B+C+D**.




A) 6 B) 7 C) 11 D) 8

7.



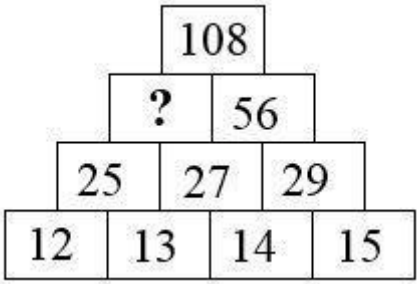

A) 126 B) 127 C) 71 D) 85

8. Alex studied 1 hours and 40 minutes on one day, 2 hours and 55 minutes the next day and 3 hours and 45 minutes on the third day. How long did he study for, in total?

A) 6 hours 40 minutes B) 6 hours

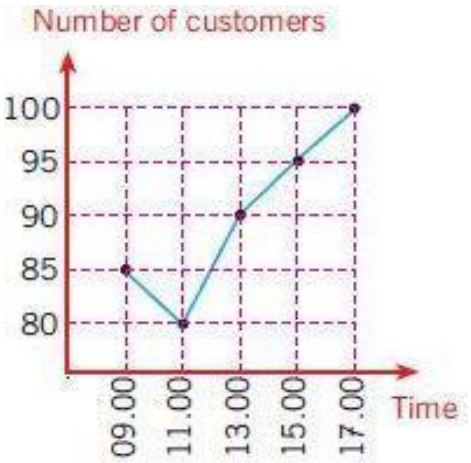
C) 7 hours 40 minutes D) 8 hours 20 minutes

9. Study the pattern and fill the missing term.



A) 52 B) 54 C) 50 D) 55

10.




The line graph above shows the number of customers coming to a restaurant at specific times on a particular day. How many customers were there in total during the day?

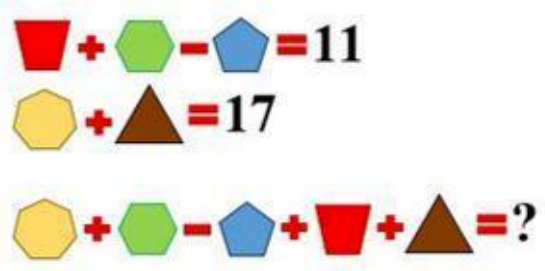
A) 450 B) 370 C) 100 D) 365

11. Calculate.

$$8+20\div2-3\times2$$

A) 13 B) 8 C) 22 D) 12

12. Work out.

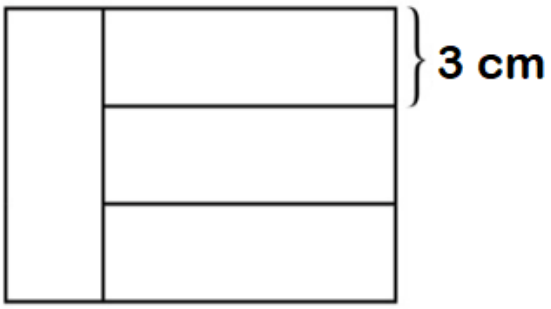



A) 6 B) 25 C) 12 D) 28

13. Simplify the expression. $3 \times (8 + 5) - 4 \times 7$.

A) 11 B) 18 C) 29 D) 39

14. Figure made up of 4 identical rectangles. What is the perimeter of the figure?

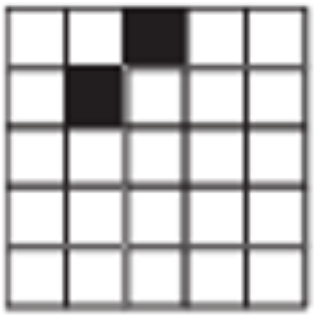



A) 36 cm B) 38 cm C) 40 cm D) 42 cm

15. What is the missing number? $200 + 300 + 400 = 100 + 200 + 300 + \ldots$

A) 500 B) 400 C) 350 D) 300

16. In the diagram below, what fraction of the figure is shaded?



A) 1/25 B) 2/25 C) 3/25 D) 25/2

17. Which one of the following has the smallest remainder?

A) $4002 \div 4$ B) $503 \div 5$ C) $604 \div 6$ D) $75 \div 7$

18. What is the sum of the smallest and the largest of the following numbers?

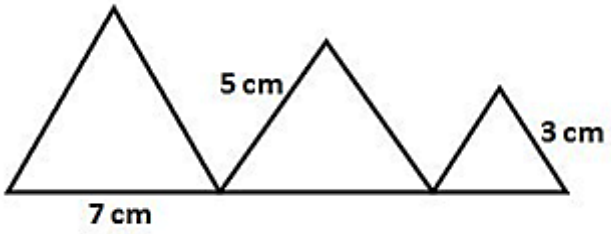
0.514, 1.823, 0.99 and 0.1770

A) 0.684 B) 1 C) 2 D) 2.82

19. If the sum of the factors of 10 is 1+2+5+10=18, then what is the sum of the factors of 12?

A) 28 B) 26 C) 18 D) 12

20. The given figure is made by three different equilateral triangles. Find the perimeter of the whole figure.

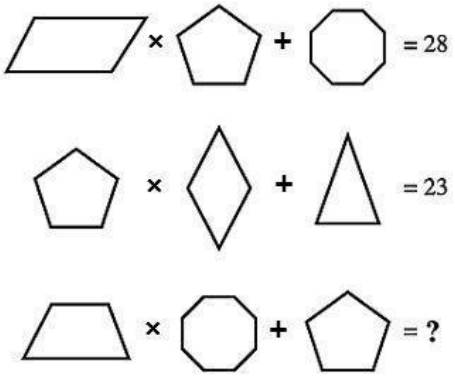



A) 30 cm B) 36 cm C) 40 cm D) 45 cm

21. Find the value of 15 - 14 + 13 - 12 + 11- 10 + 9 - 8 + 7 - 6 + 5 - 4 + 3 -2 + 1.

A) 8 B) 6 C) 12 D) 114

22. What is the value of a question mark?



A) 29 B) 37 C) 35 D) 38

23. A pet store has 30 fish tanks. Each tank holds 7 fish. How many fish are there in total?

A) 140 B) 210 C) 240 D) 280

24.

Andy has a jar with 70 marbles in it. He gives away $\frac{2}{5}$ of his marbles to his friends. How many marbles does he have left?

A) 42 B) 40 C) 30 D) 60

25. A garden has 56 plants arranged in rows. Each row has an equal number of plants. There are 4 plants in each row. How many rows are there in the garden?

A) 12 B) 13 C) 14 D) 15

26. The length of a rectangle is 17 centimeters and width is 13 centimeters. What is the perimeter of the rectangle?

A) 50 centimeters B) 60 centimeters
C) 70 centimeters D) 80 centimeters

27. Ali can type 90 words in 2.5 minutes. How many words can he type in 12 minutes?

A) 432 words B) 396 words
C) 378 words D) 450 words

28. A $3\times4\times5$ solid block is made up of $1\times1\times1$ unit cubes. The outside surface of the block is painted black. How many unit cubes have exactly one face painted black?

A) 16 B) 18 C) 20 D) 22

29. A palindrome is a whole number that is the same forward or backwards. For example 343 is a palindrome. What is the largest palindrome less than 2000?

A) 1991 B) 1999 C) 1919 D) 1111

30. At a local Thai dessert shop, egg tarts are sold in boxes of 5, 10 and 20. What is the least number of boxes that can contain 75 egg tarts?

A) 4 B) 5 C) 6 D) 7

31. A farmer has an equal number of sheep in three different fields on his farm. Which could be the number of all the sheep farmer has?

A) 224 B) 215 C) 186 D) 266

32. Calculate.

333+3033+3303+3330.

A) 9999 B) C) D)

33. What time will it be after 123 hours if it is 11:00 a.m. now?

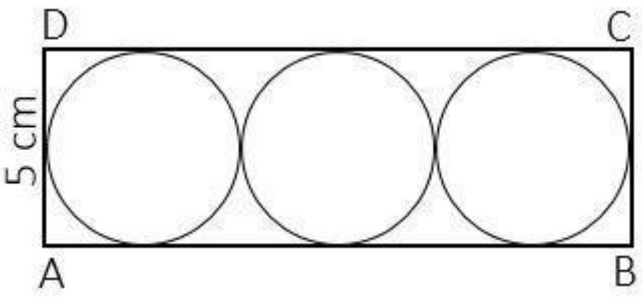
A) 07:00 a.m. B) 03:00 p.m.

C) 08:00 a.m. D) 02:00 p.m.

34. Find the product of $(30-15)(30-16)(30-17)\ldots(30-50)$.

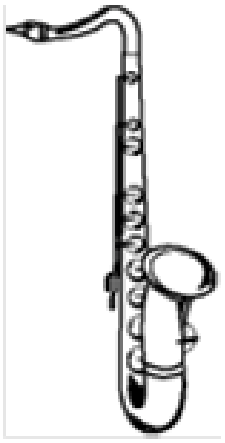
A) 0 B) 1 C) -57400 D) -12500

35. ABCD is rectangle and three identical circles touch each other and |AD|=5 cm. Find the length of |AB|.



A) 15 cm B) 10 cm C) 20 cm D) 7.5 cm

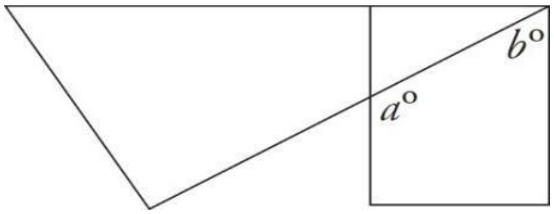
36. John practices on the saxophone for 20 minutes in each time, 4 times a day, 6 days each week. How many hours does he practice each week?



A) 8 hours B) 6.5 hours

C) 7.5 hours D) 9.5 hours

37.

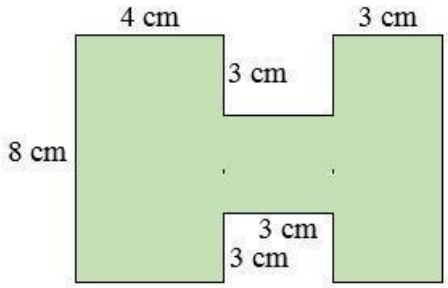



The figure above is formed by a triangle overlapping a rectangle.

What is the value of $a^o + b^o = ?$

A) 90° B) 120° C) 150° D) 180°

38. Calculate the area of the given shape.



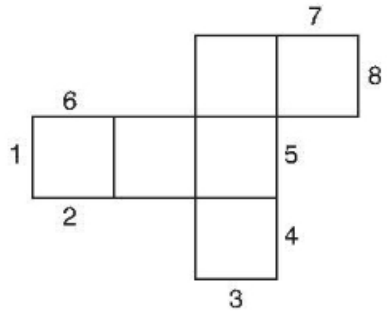

A) 62 $cm^2$ B) 65 $cm^2$ C) 73 $cm^2$ D) 77 $cm^2$

39. What letter is in the 50th position in the pattern below?

I M C O I M C O I M C O . . .

A) I B) M C) C D) O

40. A net of a cube is given in the figure below. When the net is closed, which side the side number 4 will meet?




A) 5 B) 7 C) 8 D) 1

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## PAST PAPERS 2023

### Category 2

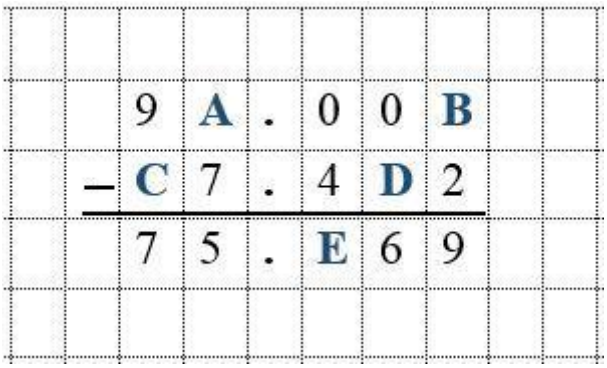
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**EXAM 2**

1. If one year equals 365 days, how many seconds are there in a year?

A) 525600 B) 31536000 C) 8760 D) 1314000

2. Subtract decimals then find **A+B+C+D+E.**

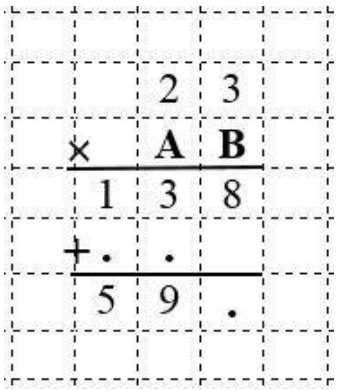



A) 13 B) 8 C) 12 D) 9

3. A car fuel tank contains 54.25 liters of fuel. The car uses 7.75 liters of fuel to travel 100 km. How far can the car travel with a full tank?

A) 700 km B) 800 km C) 600 km D) 900 km

4. Find the sum of the **A+B**.




A) 8 B) 10 C) 4 D) 2

5. Calculate.

$266 \div \left[22 - (10 + 22 \div 2) + 6 \times 22\right]$ .

A) 134 B) 2 C) 6 D) 18

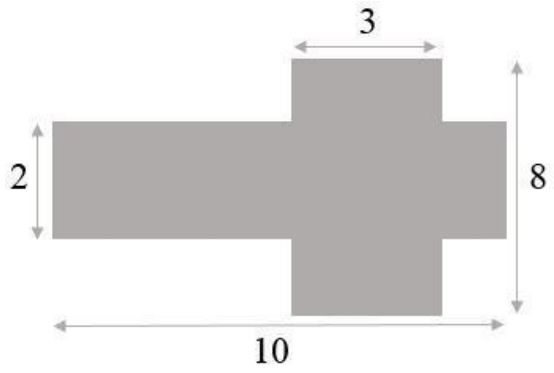
6. Calculate $1-2+3-4+5-6+\ldots+99-100$ .

A) -100 B) 50 C) -50 D) 100

7. If a, b and c are positive integers such that the greatest common factor of b and c is 1 and $2.45 = a\frac{b}{c}$ . Find the sum of $a+b+c$ .

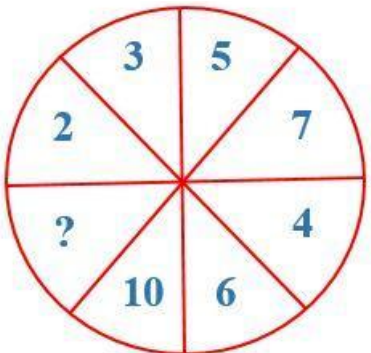
A) 31 B) 29 C) 145 D) 11

8. Find measure of the shaded area formed by the two intersecting perpendicular rectangles, in square units.



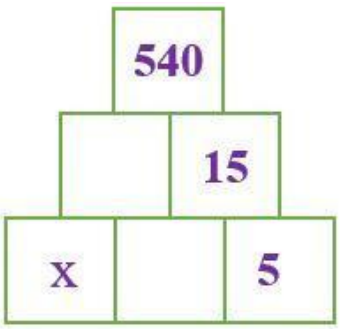

A) 74 B) 80 C) 38 D) 32

9. Find the missing number.



A) 13 B) 14 C) 12 D) 16

10. Here is multiplication pyramid. Find the x.




A) 2 B) 3 C) 18 D) 12

11. Calculate $9\div3\times(2+1)$ .

A) 1 B) 9 C) 6 D) 3

12. Which of the following is correct?

**A)** $\frac{7}{9}<\frac{35}{43}<\frac{5}{6}$ **B)** $\frac{35}{43}<\frac{7}{9}<\frac{5}{6}$

**C)** $\frac{5}{6}<\frac{35}{43}<\frac{7}{9}$ **D)** $\frac{5}{6}<\frac{7}{9}<\frac{35}{43}$

13. Find the sum of the **A+B+C+D**.

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 3 | **A** | 6 | 2 | |
| | | | **2** | **B** | 8 | |
| | + 7 | **9** | 8 | **6** | **C** | |
| | **D** | 4 | 1 | 0 | 5 | |

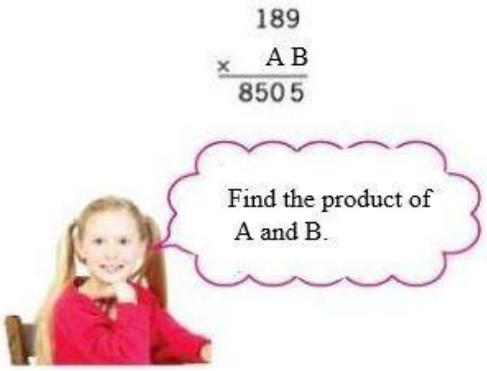
A) 15 B) 16 C) 29 D) 13

14. If $a < b$, which of the followings must be true?

I. $b^2 > a^2$
II. $3a < 3b$
III. $-b < -a$

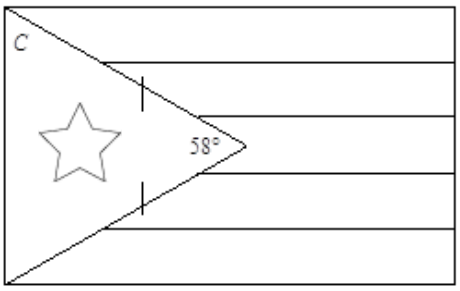
A) I only
B) I and II only
C) I and III only
D) II and III only
E) I, II and III

15. Work out.




A) 25 B) 35 C) 10 D) 20

16. A drawing of the flag of Puerto Rico is shown below. Assume that the triangle in the flag is isosceles, as shown. What is the measure, in degrees, of angle *C* in the triangle?




A) $122^0$ B) $61^0$ C) $58^0$ D) $116^0$

17. Find the next number in the pattern 4, 5, 8, 17, 44, ...

A) 80 B) 125 C) 112 D) 60

18. Which one is the same as 324÷54?

A) 806÷134 B) 2×2×2 C) 56÷2 D) (918 – 114)÷134

19. Look at this series: U32, V29, … , X23, Y20
Find the missing term.

A) W26 B) W17 C) Z17 D) Z26

20. If

$a-b=4$
$b-6=c$
$c-2=d$
$a+d=4$

Then, find the value of $a$ .

A) 4 B) 8 C) 16

D) It can't be determined from the information given.

21. 31st December 1997 was a Wednesday. How many Wednesdays were there in 1997?

A) 12 B) 51 C) 52 D) 53

22. The arithmetic mean of 1, $a$ and $b$ is equal to $2c$. The arithmetic mean of 1, $a$ and $c$ is equal to $2b$. The arithmetic mean of 1, $b$ and $c$ is equal to $2a$. Find the arithmetic mean of $a$, $b$ and $c$.

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

23.




The tick marks on the number line above are equally spaced. If 2 is halfway between $b$ and $c$, and the value of $c - a$ is 10, what is the value of $b$?

A) –4 B) –2 C) 0 D) 4

24. The table below shows the results of a random survey of 500 men and women. Each individual chose a flavor of ice cream that was his or her favorite. Approximately what percent of the men chose mint chip as their favorite ice cream flavor?

**Favorite Ice Cream Flavors**

| | Men | Women | Total |
|---|---|---|---|
| Chocolate | 74 | 63 | 137 |
| Vanilla | 68 | 22 | 90 |
| Strawberry | 17 | 39 | 56 |
| Cookie Dough | 51 | 87 | 138 |
| Mint Chip | 65 | 14 | 79 |
| Total | 275 | 225 | 500 |

A) 24% B) 26% C) 28% D) 30%

25. A car travels from point A to B in 3 hours and returns back to point A in 5 hours. Points A and B are 150 km apart along a straight highway. What is the average speed of the car during the trip?

A) 43 km/h B) 45 km/h C) 40.7 km/h D) 37.5 km/h

26. A toy store offers a 40% discount on all items. If a toy originally costs $50, what will be the discounted price?

A) $30 B) $40 C) $20 D) $10

27. The sum of two consecutive even numbers is 98. What are those numbers?

A) 48 and 50 B) 52 and 50 C) 54 and 52 D) 56 and 54

28. Elsa spends 30% of her salary on rent, 20% on groceries and 25% on entertainment. If her remaining salary is $500, what is her salary?

A) $2000 B) $3000 C) $4000 D) $5000

29. A box contains red, yellow and green apples with ratio 3:2:5. If there are 1000 apples in total, how many of them are red?

A) 300 B) 400 C) 500 D) 600

30. A 3×4×5 solid block is made up of 1×1×1 unit cubes. The outside surface of the block is painted black. How many unit cubes have exactly one face painted black?

A) 16 B) 18 C) 20 D) 22

31. If $a$ and $b$ are positive integers such that $a+\frac{1}{b}=2.5$, then what would be the decimal result of $\frac{b}{ab+1}$ ?

A) 0.4 B) 0.5 C) 0.25 D) 1.25

32. Simplify $\frac{1}{2}-\left(\frac{1}{2}-\frac{1}{3}\right)-\left(\frac{1}{2}+\frac{1}{3}-\frac{1}{6}\right)$.

A) $-\frac{1}{3}$ B) $-\frac{1}{4}$ C) $-\frac{1}{6}$ D) $\frac{1}{2}$

33. Solve $0.36x-0.9=0.12x+0.3$

A) 4 B) 0.2 C) 0.5 D) 5

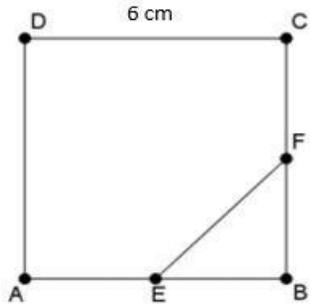
34. What is the measure of the smaller angle made by the minute hand and hour hand of the clock at 10 past 3?




A) 30° B) 32°

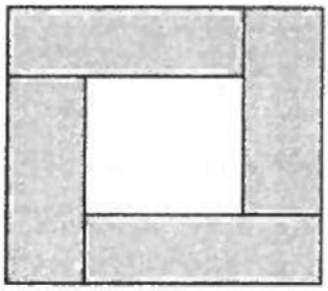
C) 34° D) 35°

35. In the square with the side lengths of 6cm below, E and F are the midpoints of the sides. What is the value of the square of the length EF? ($|EF|^2$ =?)



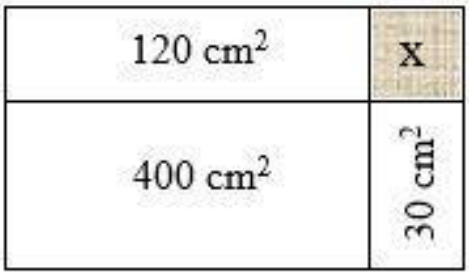

A) 18 B) 36 C) 8 D) 25

36. The diagram shows 4 identical rectangles and an outer and an inner square.
If the perimeter of each rectangle is 40 cm, the area of inner square is 16 $cm^2$, what is the area of each of the rectangles in $cm^2$ ?



A) 100 B) 99 C) 96 D) 91

37. Find the shaded area of the rectangle below?




A) 6 $cm^2$ B) 9 $cm^2$ C) 10 $cm^2$ D) 12 $cm^2$

38. Calculate 444+4044+4404+4440.

A) 13332 B) 12222 C) 12332 D) 13222

39. What letter is in the 100th position in the pattern below?

I M C O I M C O I M C O . . .

A) I B) M C) C D) O

40. Kevin found a cubic box with an open top. Each side is 8 cm long. If he fills this box with identical cubes with $2cm \times 2cm \times 2cm$, how many of these cubes will be touching the box?

A) 40 B) 48 C) 52 D) 56

# International Online Math Challenge

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## PAST PAPERS 2023

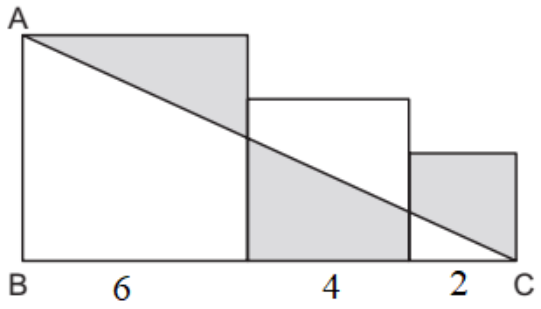
### Category 3

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**EXAM 3**

1. In the figure below, ABC is right triangle at which its base is on a side of each square. If the sides of the squares are 6, 4 and 2 respectively.

What is the area (square units) of the shaded region?




A) 20 B) 18 C) 16 D) 14

2. A ball is dropped from a height of 5 m. Each time it bounces it reaches 0.6 times its previous height. How many times must the ball bounce until its height reaches less than 50 cm?

A) 5 times B) 6 times C) 3 times D) 10 times

3. I want to purchase a famous Iran carpet for my room. The carpet is 2.75 m wide and 3.25 m long, and the cost is $15.5 per square meter. How much should be my budget to buy carpet?

A) $130 B) $120 C) $100 D) $140

4. An investigation of a number car accidents showed the following:

13 accidents involved alcohol and excessive speed,

21 accidents involved alcohol,

12 accident involved excessive speed but not alcohol, and

19 of the accidents involved neither alcohol nor excessive speed.

How many accidents were investigated?

A) 44 B) 46 C) 52 D) 65

5. Calculate:

$$1-\cfrac{1}{1+\cfrac{1-\cfrac{1}{2}}{1-\cfrac{1}{2}}}$$

.

A) $-1$ B) $1$ C) $3$ D) $2$

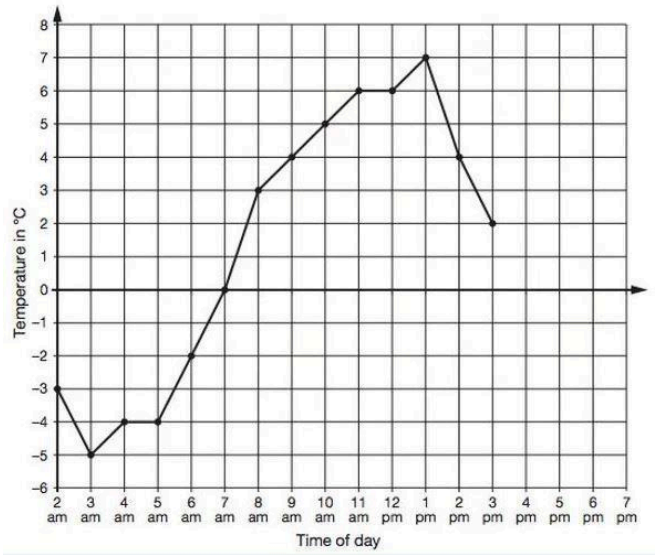
6.




The perimeter of the rectangular table above left is equal to the perimeter of the square table at the right. Find the side length of the square table.

A) 52 B) 105 C) 210 D) 110

7. This graph shows the temperature in $^0$C from 2 am to 3 pm on a cold day. How many degrees colder was it at 5 am than at 1 pm?



A) $11^0$C B) $7\ ^0$C C) $3\ ^0$C D) $4\ ^0$C

8. Find x.

$$\frac{1}{3-\frac{1}{1-\frac{1}{x}}}=1$$

A) -1 B) 1 C) 3 D) 2

9. Calculate $24\div3\times4-2\times3+15\div3$ .

A) 31 B) 5 C) -8 D) 1

10. Calculate.

$$\frac{(-1)^{1001}\times(-1)^{2002}\times(-1)^{3003}}{(-1)^{2022}\div(-1)^{2033}}$$

A) 0 B) 6006 C) 1 D) -1

11. Calculate $\left(1-\frac{1}{2}\right)\left(1-\frac{1}{3}\right)\left(1-\frac{1}{4}\right)\ldots\left(1-\frac{1}{100}\right)$ .

A) $\frac{1}{99}$ B) $\frac{1}{100}$ C) $\frac{99}{100}$ D) $\frac{101}{99\times100}$

12. Calculate $\sqrt[4]{8\times\sqrt{1-\sqrt[3]{-27}}}$ .

A) -3 B) 1 C) 2 D) -1

13. Kevin found a cubic box with an open top. Each side is 8 cm long. If he fills this box with identical cubes with $2cm \times 2cm \times 2cm$, how many of these cubes will be touching the box?

A) 40 B) 48 C) 52 D) 56

14. At the end of a banquet, 6 people shake hands with each other. How many handshakes will there be in total?

A) 10 B) 12 C) 15 D) 18

15. If the lines $y = 5x + 31$ and $y = -2x - 25$ intersect at point$(h, k)$, what is the value of $k$?

A) -7 B) 9 C) -8 D) -9

16. A restaurant has two types of tables, rectangular ones that can each seat 4 people and circular tables that can each seat 8 people. If all 30 tables at the restaurant can seat 144 people exactly, how many rectangular tables does the restaurant have?

A) 12 B) 16 C) 20 D) 24

17. A train travels from town A to town B at an average speed of 70 km/h. On the return journey, the train travels at an average speed of 80 km/h. If the total travel times for the round trip is 5 hours, what is the distance between the two towns to the nearest natural number?

A) 187 km B) 157 km C) 177 km D) 167 km

18. A triangle has side lengths of 6 cm, 9 cm and 12 cm. Is it a right triangle? If yes, which of those lengths is hypotenuse?

A) Yes, 12 cm B) No C) Yes, 6 cm D) Yes, 9 cm

19. If $\{2x - 3y = 6 \quad 3x - 2y + z = 9$ then $x + y + z$

A) 8 B) 5 C) 3 D) 1

20. In a class of 25 students, the average score on a final test calculated for 20 students was 75. Five students missed the test day with cold symptoms and were scheduled for a make-up. The average score of these five students was eventually 80. What is the average score of the class?

A) 80 B) 79 C) 78 D) 76

21.

| *x* | *f(x)* |
|---|---|
| 0 | *m* |
| 1 | 40 |
| 2 | *n* |

If *f(x)* is a linear function defined according to the table above, what is the value of $m + n$?

A) 160 B) 40 C) 120 D) 80

22. A sequence is defined by $a_0 = 0$ and $a_{n+1} = \frac{a_n - 3}{a_n - 2}$ for all integers n ≥ 0 and $a_n \neq 2$ for all natural numbers n. Find the $a_{2020}$.

A) 0 B) 1 C) $\frac{3}{2}$ D) none of these

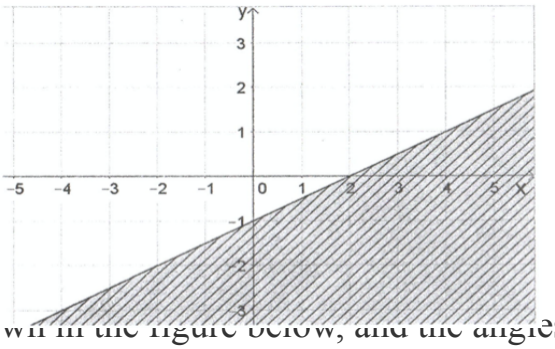
23. If $n^3 = x$ and $n^4 = 20x$, where $n > 0$, what is the value of $x$?

A) 20 B) 400 C) 4000 D) 8000

24. A $3 \times 4 \times 5$ solid block is made up of $1 \times 1 \times 1$ unit cubes. The outside surface of the block is painted black. How many unit cubes have exactly one face painted black?

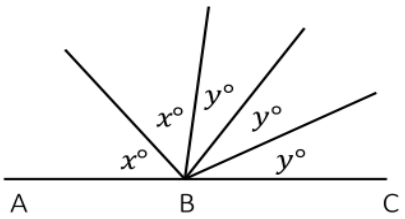
A) 16 B) 18 C) 20 D) 22

25. Determine the inequality corresponding to the graph.



A) $y - 3x + 6 \geq 0$
B) $y - 3x + 6 \leq 0$
C) $0.5x - 1 \geq y$
D) $0.5x - 1 \leq y$

26. If ABC is a straight line as shown in the figure below, and the angles x° and y° are integer multiples of 20, what is the value of x°?




A) 20° B) 40° C) 60° D) 80°

27. The chemical solution contains 40% salts. If you add 120 g of salt, the solution will contain 70% salt. Find the mass of salt in the initial solution.

A) 50 $g$ B) 42 $g$ C) 40 $g$ D) 48 $g$

28. Which of the following shows the numbers $2^{1/2}$, $3^{1/3}$ and $6^{1/6}$ in increasing order?

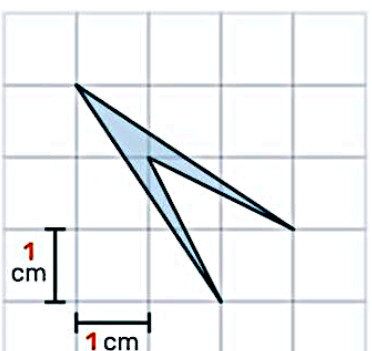
A) $2^{1/2} < 3^{1/3} < 6^{1/6}$

B) $6^{1/6} < 3^{1/3} < 2^{1/2}$

C) $6^{1/6} < 2^{1/2} < 3^{1/3}$

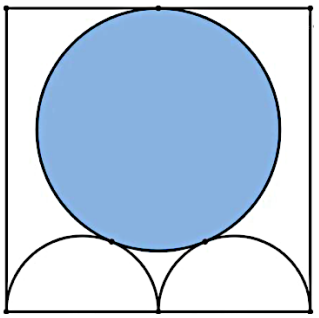
D) $3^{1/3} < 2^{1/2} < 6^{1/6}$

29. Find the area of the shaded region.



A) 1 B) $\frac{3}{2}$ C) $\frac{2}{3}$ D) $\frac{1}{2}$

30. Side of the square is 8 cm. If the two semicircles are identical, find the area of the shaded circle.



A) $11.56\pi\ cm^2$ B) $10.89\pi\ cm^2$
C) $10.24\pi\ cm^2$ D) $9.61\pi\ cm^2$

31. If x, y, x+y and x-y are not zero, then simplify the expression

$$\left(\frac{x}{x+y}-\frac{x-y}{x}\right)\div\left(\frac{x}{x-y}-\frac{x+y}{x}\right).$$

A) $y$ B) $x$ C) $\frac{x+y}{x-y}$ D) $\frac{x-y}{x+y}$

32. If $x=\frac{1}{y+2}$ where y ≠ 2, then evaluate the expression $y+yx+2x-\frac{1}{x}+3$.

A) 5 B) 4 C) 3 D) 2

33. If $x<0$, then evaluate $|x-1|+|x|+3$.

A) $x+2$ B) $4-2x$ C) $2x-2$ D) $2x+2$

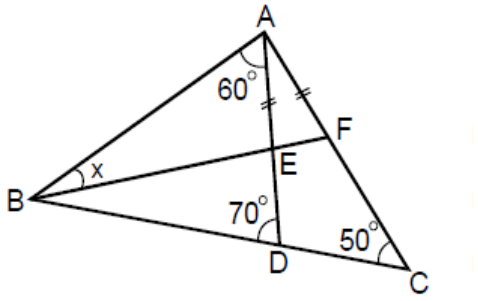
34. ABC is a triangle, |AE| = |AF| and

$\angle BAD = 60^o$

$\angle ADB = 70^o$

$\angle ACB = 50^o$

Find x .




A) 20° B) 30° C) 50° D) 35°

35. Simplify $3\sqrt{8}+2\sqrt{2}-(\sqrt{8}+\sqrt{2})$.

A) $\sqrt{2}$ B) $5\sqrt{2}$ C) $3\sqrt{2}$ D) $\sqrt{8}$

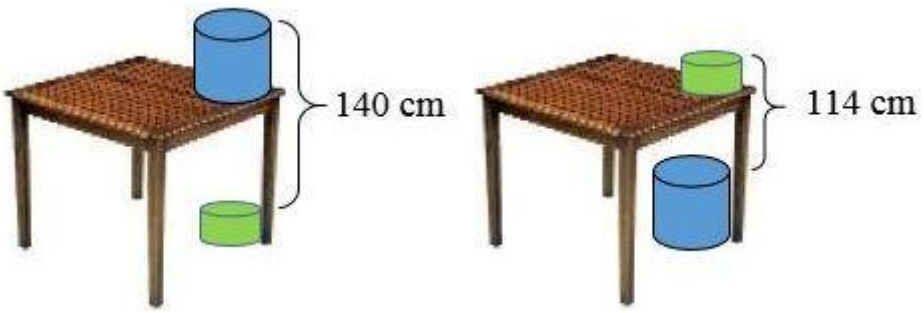
36. If $\frac{x}{y}=\frac{7}{4}$ and $x-y=\frac{3}{2}$, then find $y$.

A) -4 B) -1 C) 2 D) 6

37. In a class of 25 students, 20 study physics, 15 study chemistry and 10 study both subjects. How many students study only one of the two subjects?

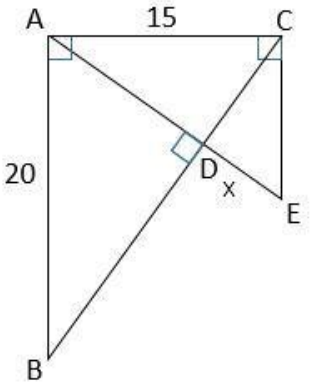
A) 20 B) 10 C) 15 D) 25

38. Find the height of the table.




A) 54 cm B) 81 cm C) 127 cm D) 254 cm

39. Find the value of x.




A) $7\frac{1}{2}$ B) $8\frac{1}{3}$ C) $6\frac{3}{4}$ D) $7\frac{1}{5}$

40. Find x×y , if $2^x + 2^y = 320$ where x, y are natural numbers.

A) 35 B) 63 C) 48 D) 24

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## PAST PAPERS 2023

### Category 4

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**EXAM 4**

1. A train 300 meter long is traveling at a speed of 80 km/h. How long will it take the train to go completely through a tunnel which is 1.7 km long?

A) 1.5 minutes B) 2.5 minutes C) 7.5 minutes D) 5.5 minutes

2. In an airplane, the passengers are asked which languages they can speak. 41 passengers can speak only Russian, 67 can speak only English, 72 can speak only Chinese, 15 can speak English and Russian, 12 can speak Russian and Chinese, 35 can speak English and Chinese, and 5 can speak English, Russian and Chinese. Find the number of passengers in the airplane.

A) 247 B) 242 C) 180 D) 232

3. Calculate.

$$3+\cfrac{1-\cfrac{1}{3}}{1+\cfrac{1+\cfrac{1}{3}}{1-\cfrac{1+\cfrac{1}{4}}{1-\cfrac{1}{4}}}}$$

A) $7.5$ B) $2.5$ C) $-1$ D) $-1.5$

4. Calculate.

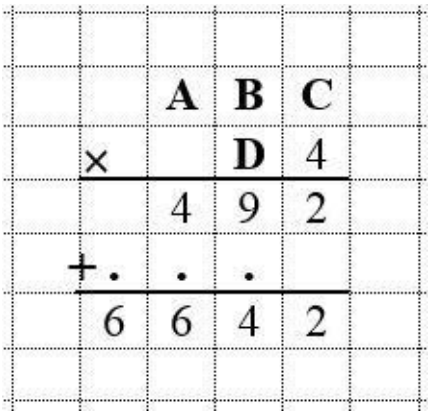
$$\frac{3^{2023}+3^{2022}}{3^{2023}-3^{2022}}$$

A) 2 B) $3^{2022}$ C) 3 D) $3^{2023}$

5. Calculate. $\frac{1}{1\times 2}+\frac{1}{2\times 3}+\frac{1}{3\times 4}+\ldots+\frac{1}{99\times 100}$.

A) $\frac{1}{99}$ B) $\frac{1}{100}$ C) $\frac{99}{100}$ D) $\frac{101}{99\times 100}$

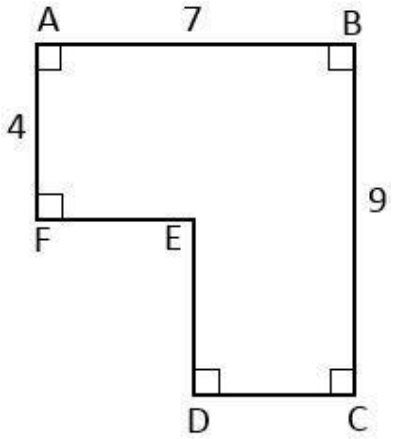
6. Find the sum of the **A**+**B**+**C**+**D**.




A) 11 B) 8 C) 21 D) 6

7. The area of polygon ABCDEF is 43 with |AB|=7, |BC|=9 and |FA|=4.

Find |DE|+|EF|.




A) 8 B) 9 C) 8.5 D) 7

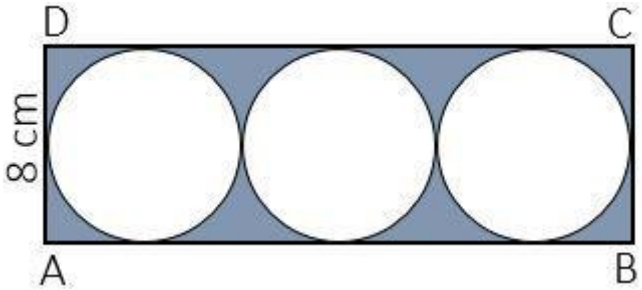
8. If $6^x = 2^{x+1}$, then find $27^x$.

A) 8 B) 2 C) 9 D) 16

9. Calculate. $\frac{3}{3+\sqrt{3}}+\frac{3}{2\sqrt{3}}$ .

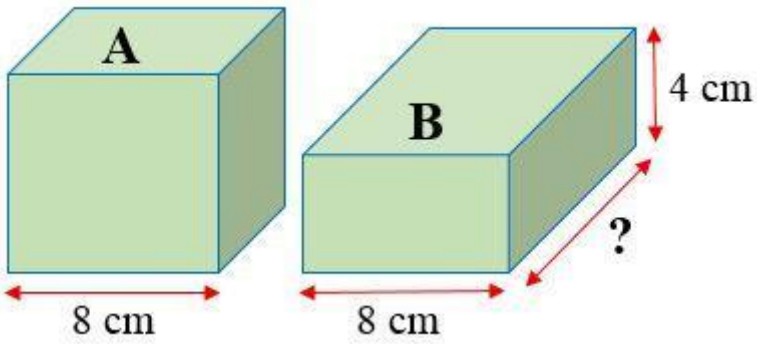
A) $2\sqrt{3}$ B) $\sqrt{3}$ C) 3 D) 1.5

10. ABCD is a rectangle, three identical circles touch each other and |AD|=8 cm. Find the area of shaded region (π=3).



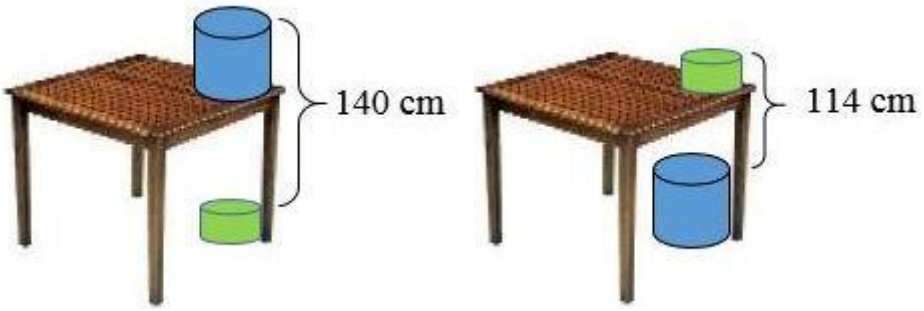

A) 48 $cm^2$ B) 3610 $cm^2$ C) 60 $cm^2$ D) 58 $cm^2$

11. The volume of the cube A and cuboid B are equal. Find the length of the cuboid.




A) 7 cm B) 8 cm C) 16 cm D) 12 cm

12. Find the height of the table.



A) 54 cm B) 81 cm C) 127 cm D) 254 cm

13. The equation of a circle in the xy-plane $x^2+y^2+2x-6y=-1$ is given. Find the coordinate of the center of a circle.

A) (-1, 3) B) (1, -3) C) (2, 6) D) (1, 3)

14. If $0 < pt < 1$, $p$ is a negative integer and $t$ is a real number, which of the following must be less than $-1$ ?

A) $p$
B) $p - t$
C) $t + p$
D) It can't be determined from the information given.

15. A $3\times4\times5$ solid block is made up of $1\times1\times1$ unit cubes. The outside surface of the block is painted black. How many unit cubes have exactly one face painted black?

A) 16 B) 18 C) 20 D) 22

16. A cube has a volume of 125 cubic centimeters. What is the surface area of the cube?

A) 150 $cm^2$ B) 120 $cm^2$ C) 115.5 $cm^2$ D) 110 $cm^2$

17. The sum of a finite arithmetic series is 385. The first term is 10 and the common difference is 5. How many terms are in the series?

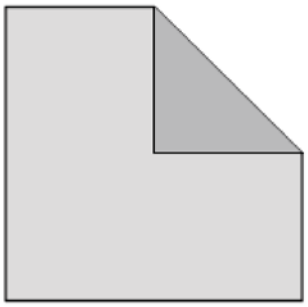
A) 10 B) 11 C) 12 D) 13

18. Calculate.

$0.3+0.03+0.003+...$

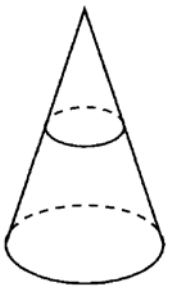
A) $\frac{2}{3}$ B) $\frac{4}{9}$ C) $1$ D) $\frac{1}{3}$

19. One corner of a square is folded to its centre to form an pentagon as shown in the diagram. The area of the square is 1 square unit greater than the area of the pentagon. What is the area of the square?



A) 2 B) 4 C) 8 D) 16 16

20. In the figure below, the base of a cone has a radius of 6. The cone is sliced horizontally so that the top piece is a smaller cone with a height of 1 and a base radius of 2. What is the height of the bottom piece?



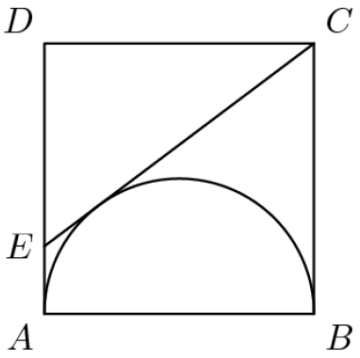
Note: Figure not drawn to scale.

A) 1 B) 2 C) 3 D) 4

21. If $4a = 2b + 1$, what is the value of $\frac{81^a}{9^b}$?

A) 3 B) 9 C) 27 D) 81

22. Square ABCD has side length 2. A semicircle with diameter AB is constructed inside the square, and the tangent to the semicircle from C intersects side AD at E. What is the length of CE?




A) $\sqrt{6}$ B) $5 - \sqrt{5}$ C) 5/2 D) $\sqrt{5}$

23. Solve the system inequality.

$\{2(x - 1) - 3(x - 4) > x + 5 \frac{3x-4}{x^2+4x+4} \geq 0$

A) $(-\infty, \frac{4}{3}] \cup [2.5, +\infty)$ B) $[\frac{4}{3}, 2.5]$

C) $(-\infty, \frac{4}{3}] \cup (2.5, +\infty)$ D) $[\frac{4}{3}, 2.5)$

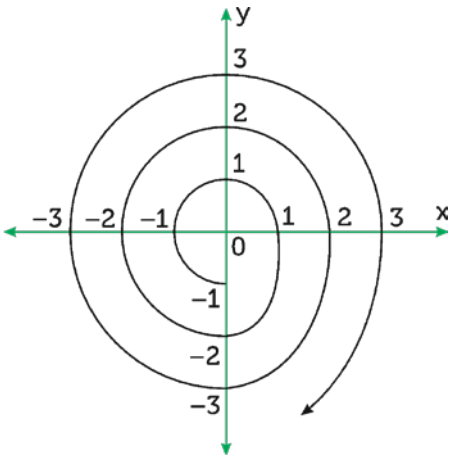
24. Find the sum of all positive even two-digit numbers which are divisible by 3.

A) 806 B) 816 C) 826 D) 810

25. Solve the equation $x^{-\frac{2}{3}} = 0.04$.

A) 250 B) $\pm 125$ C) $\pm 120$ D) -129

26. Below is a spiral curve that intersects the x and y axes. If first point has $(0, \ -1)$ coordinate and fifth point has $(0, \ -2)$ coordinate, then determine the coordinate of 109th point.




A) $(0, -27)$ B) $(-27, \ 0)$

C) $(0, \ -28)$ D) $(-28, \ 0)$

27. Vertices of triangle ABC are $A(5, \ -7)$, $B(1, \ 3)$ $and$ $C(-1, \ 9)$. Write the equations of the median BM of the triangle where M is the midpoint of side AC.

A) $y = 2x + 1$ B) $y = -2x + 5$ C) $y = 5x - 2$ D) $y = -5x + 8$

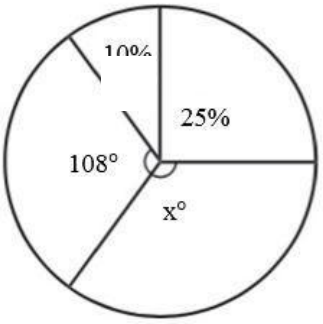
28. Simplify $\left[\left(\frac{0.025}{0.05}\right) \div \left(\frac{1}{2} - 1\right)\right]^{-\frac{1}{3}}$

A) 0 B) 1 C) -1 D) 2

29. If $\frac{a-1}{2} = \frac{b-3}{3} = \frac{c+1}{4}$ and $b = 2c - a$, then find $a + b + c$.

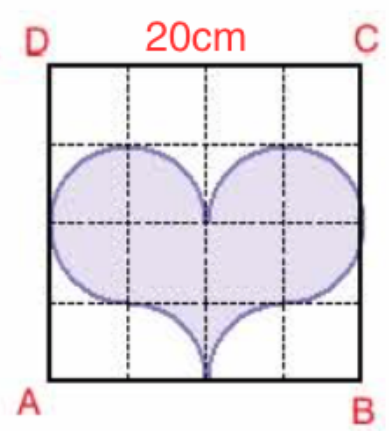
A) 19 B) 20 C) 21 D) 22

30. Find x°.



A) 126°  B) 136°  C) 144°  D) 152°

31. Find the area of the "heart" in square centimeters.



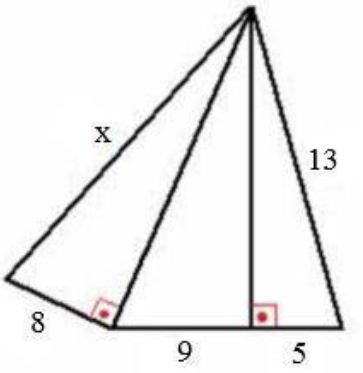

A) $50 + 15\pi$
B) $150 + 40\pi$
C) $100 + 25\pi$
D) $75 + 55\pi$

32. If five men can dig 100 pits over four days, how many men would be needed to dig 150 pits in one day?



A) 20  B) 25  C) 30  D) 35

33. Find the value of x.




A) 13  B) 15  C) 17  D) 19

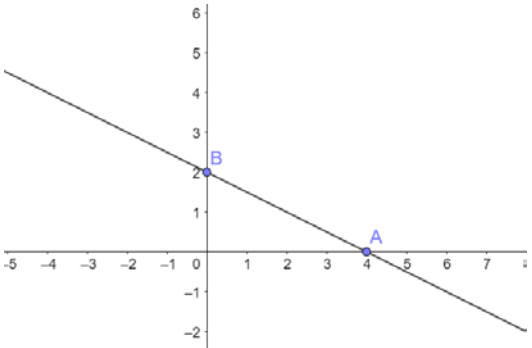
34. If $2^x = a$ and $3^x = b$, then find $48^x$.

A) $ab$  B) $a^2b$  C) $a^3b^2$  D) $a^4b$

35. In the figure below, the graph of $y = f(x)$ is shown. Which of the following could be the equation of $f(x)$?

A) $f(x) = -\frac{x}{2} - 2$

B) $f(x) = -\frac{x}{2} + 2$



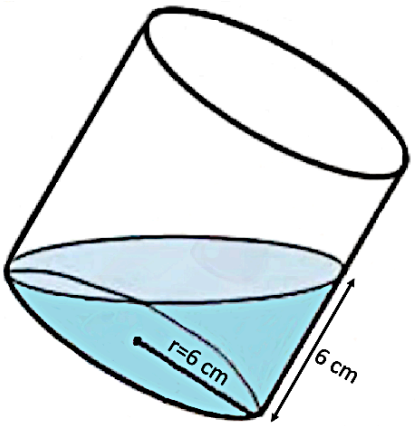
C) $f(x) = \frac{x}{2} - 2$

D) $f(x) = \frac{x}{2} + 2$

36. In the quadratic equation $y = a(x - 3)(x - k)$, where $a$ and $k$ are constant. If the graph of the equation in the $xy$ −plane is a parabola with vertex $(5, \ -32)$ , then what is the value of $a$?

A) 8 B) 7 C) 6 D) 5

37. Find the volume of the water.




A) $108\pi\ cm^3$

B) $144\pi\ cm^3$

C) $72\pi\ cm^3$

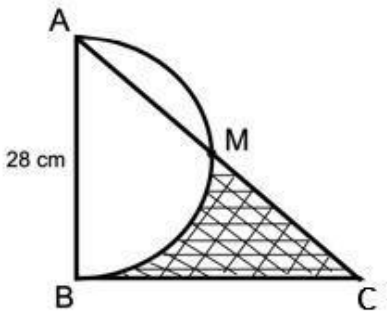
D) $84\pi\ cm^3$

38. ABC is a right triangle and |AB|=28 cm. AMB is a semicircle where M is the midpoint of the arc AMB. What is the shaded area in the figure?

(Take = $\frac{22}{7}$ .)

A) 130 $cm^2$ B) 140 $cm^2$

C) 150 $cm^2$ D) 160 $cm^2$




39. In the addition table below, the letters a, b and c each stand for a positive number. Accordingly, what is the value of a?

A) 6 B) 8 C) 9 D) 10

| + | a | b | c |
|---|---|---|---|
| a | | | 13 |
| b | 17 | | |
| c | | 3a | |

40. Kevin found a cubic box with an open top. Each side is 8 cm long. If he fills this box with identical cubes with $2cm \times 2cm \times 2cm$, how many of these cubes will be touching the box?

A) 40 B) 48 C) 52 D) 56

# International Online Math Challenge

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## PAST PAPERS 2023

### Category 5

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**EXAM 5**

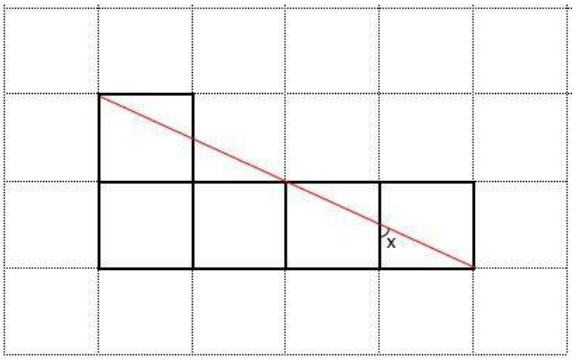
1. In an airplane, the passengers are asked which languages they can speak. 41 passengers can speak Russian, 67 can speak English, 72 can speak Chinese, 15 can speak English and Russian, 12 can speak Russian and Chinese, 35 can speak English and Chinese, and 5 can speak English, Russian and Chinese. Find the number of passengers.

A) 127 B) 123 C) 172 D) 140

2. Let $n(A-B)=15$, $n(B-A)=13$ and $n(A\cup B)=45$. Find $n(A\cap B)$.

A) 17 B) 28 C) 32 D) 30

3. All the squares in the figure are congruent and have side 1 unit. Find the $\sin x$.




A) $\frac{4\sqrt{5}}{5}$ B) $2\sqrt{5}$ C) $\frac{2\sqrt{5}}{5}$ D) $4\sqrt{5}$

4. Calculate. $5^{a+2}$ if $25^{a}=3$.

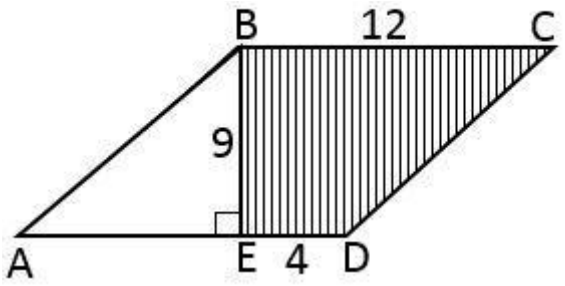
A) $25\sqrt{3}$ B) $5\sqrt{3}$ C) $3\sqrt{5}$ D) $\sqrt{3}$

5. Calculate.

$$\frac{4-\frac{2+\frac{2}{3}}{2}}{3+\frac{2-\frac{2}{3}}{4}}-1=?$$

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

6. ABCD is a parallelogram. Find the area of shaded region.




A) 48 B) 18 C) 54 D) 72

7. If $60^{a}=3$ and $60^{b}=5$ then calculate $12^{\frac{1-a-b}{1-b}}$.

[use logarithm to evaluate]

A) 144 B) 4 C) 225 D) 15

8. Calculate. $\sqrt[3]{9+\sqrt{80}}+\sqrt[3]{9-\sqrt{80}}$.

A) 3 B) 9 C) 1 D) $\sqrt[3]{9}$

9. Simplify.

$$\frac{\left(5^{\frac{1}{2}}-1\right)}{\left(5^{\frac{1}{8}}+1\right)\left(5^{\frac{1}{8}}-1\right)}$$

A) $5^{\frac{1}{2}}-1$ B) $5^{\frac{1}{4}}-1$ C) $5^{\frac{1}{2}}+1$ D) $5^{\frac{1}{4}}+1$

10. If $\left.\begin{matrix} a+b-c=2 \\ a^2+b^2+c^2=6 \end{matrix}\right\}$, then calculate the value of $ac+bc-ab$.

A) 3 B) 8 C) 4 D) 1

11.

If $\frac{1}{x^2}+16x^2=32$ for a positive real number $x$, then calculate the value of $4x+\frac{1}{x}$.

A) $\sqrt{40}$ B) 24 C) 16 D) 48

12. If $\left.\begin{matrix} a-b=21 \\ \sqrt{a}-\sqrt{b}=3 \end{matrix}\right\}$, then calculate the value of $a+b$.

A) 33 B) 28 C) 27 D) 29

13.

The equation of a circle in the xy-plane $x^2+y^2+6x-2y=-1$ is given. Find the radius of the circle.

A) 2 B) 3 C) 4 D) 9

14. Given that $\frac{1}{a}+\frac{1}{b}=2$ and $3^a=5^b=x$. Find the value of x.
[use logarithms to evaluate]

A) $x=225$ B) $x=15$ C) $x=\sqrt{15}$ D) $x=\sqrt[3]{15}$

15. A 3×4×5 solid block is made up of 1×1×1 unit cubes. The outside surface of the block is painted black. How many unit cubes have exactly one face painted black?

A) 16 B) 18 C) 20 D) 22

16.

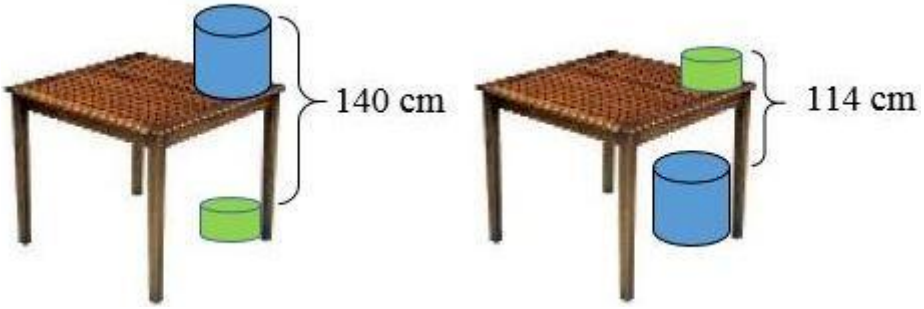
If $f(x) = 4 + 2x^2$, find the integer value of $k$ for which $(2k) = 18k$ .

A) –2 B) 0 C) 1 D) 2

17. Solve the equation $7\times3^{x+1} - 5^{x+2} = 3^{x+4} - 5^{x+3}$.

A) $-2$ B) $-1$ C) 0 D) 1

18. Find the height of the table.




A) 54 cm B) 81 cm C) 127 cm D) 254 cm

19. If $x + 2$ is a factor of $x^4 + x^3 + 3x^2 + kx - 10$ , then find $k$.

A) $-5$ B) $-13$ C) 15 E) 5

20. Simplify. $\frac{[(n+1)!]^3}{(n!)^3}$

A) $n$ B) $n + 1$ C) $n^3$ D) $(n + 1)^3$

21. A right circular cone has a base radius of $r$ and a height of $h$. If the radius is decreased by 20 percent and the height is increased by 10 percent, which of the following is the resulting percent change in the volume of the cone?

A) 10% decrease
B) 12% decrease
C) 18.4% decrease
D) 29.6% decrease

22.

In the $xy$ −plane, the line $y = 2x + b$ intersects the parabola $y = x^2 + bx + 5$ at the point$(3,\ k)$. If $b$ is a constant, what is the value of $k$?

A) 0 B) 1 C) 2 D) 3

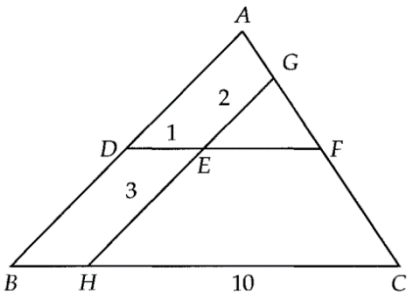
23. If $|4x - 4| = 8$ and $|5y + 10| = 15$, what is the smallest possible value of $xy$?

A) $-1$ B) $-3$ C) $-5$ D) $-15$

24. In the figure below, $\overline{AB}$ is parallel to $\overline{GH}$ and $\overline{DF}$ is parallel to $\overline{BC}$.

If $|DE| = 1, |EH| = 3, |EG| = 2$, and $|HC| = 10$, what is the length of $|AD|$ ?

A) 2.5 B) 3 C) 3.5 D) 4



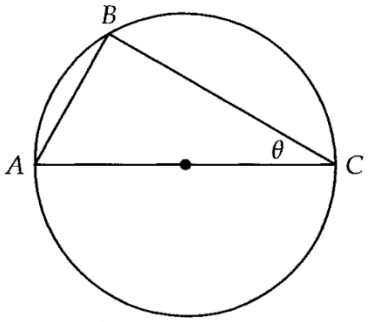

Note: Figure not drawn to scale.

25.

In the figure below, $AC$ is a diameter of the circle. If $AC = 1$, which of the following gives the area of triangle $ABC$ in terms of θ?

A) $\frac{\theta}{2}$

B) $\frac{tan\theta}{2}$



C) $2sin\theta$

D) $\frac{\text{sin}sin\,\theta\text{cos}cos\,\theta}{2}$

26.
The table below summarizes the distribution of living situations for residences in a neighborhood. If a duplex in the neighborhood is to be inspected at random, what is the probability that the residence is occupied by no more than 2 family members?

| | Type of Residence | | | |
|---|---|---|---|---|
| Family members | Apartment | Duplex | Single residence | Total |
| 1 | 10 | 22 | 3 | 35 |
| 2 | 20 | 12 | 13 | 45 |
| 3 | 8 | 8 | 12 | 28 |
| 4 or more | 8 | 4 | 18 | 30 |
| Total | 46 | 46 | 46 | 138 |

A) $\frac{6}{23}$
B) $\frac{17}{23}$
C) $\frac{15}{23}$
D) $\frac{11}{23}$

27. Evaluate $7\,5\ \times 4\ +\ 1$.

A) 12 B) 4 C) 16 D) 2

28. Find the increasing interval of function $f(x) = \sqrt{x^2 - 1}$.

A) $(-\infty; -1) \cup (1; +\infty)$ B) $(-\infty; -1] \cup [1; +\infty)$

C) $[1; +\infty)$ D) $(-\infty; -1]$

29. Find the area of the figure bounded by $y = x^3,\ x = y^2$.

A) 1 B) $\frac{5}{12}$ C) $\frac{1}{4}$ D) $\frac{2}{3}$

30. Solve $\int \frac{cos^2 x}{1-sinx} dx$

A) $x + cosx + C$ B) $x + sinx + C$

C) $x - cosx + C$ D) $1 - sinx + C$

31.

$A(2, -1, -3)$, $B(-3, 5, 2)$, $C(-2, 3, -5)$ are the vertices of triangle $ABC$. If $BM$ is a median of triangle $ABC$, then find the length of $BM$.

A) $\sqrt{57}$ B) $\sqrt{55}$ C) 9 D) $\sqrt{61}$

32.

Given the arithmetic sequence $15, 20, 25, \ldots$ . Determine which term of arithmetic sequence is equal to 265.

A) $49^{th}$ B) $57^{th}$ C) $51^{st}$ D) $55^{th}$

33. Given that $f(x - 1) = 3x + 4$, find the $f(2x + 1)$.

A) $6x + 10$ B) $3x + 10$

C) $6x + 9$ D) $6x^2 + 11x + 4$

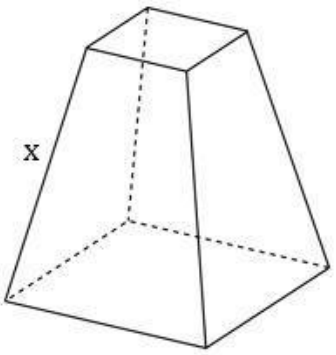
34. Evaluate the sum of the first six terms of the geometric sequence $2, 1, \frac{1}{2}, \ldots$ .

A) $\frac{73}{22}$ B) $\frac{31}{8}$ C) $\frac{63}{16}$ D) $\frac{57}{16}$

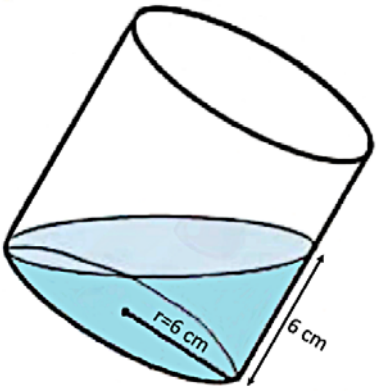
35.

The sides of the bottom and top bases of the regular frustum square pyramid are 6 $cm$ and 4 $cm$, respectively, and height $\sqrt{23}cm$. Find the length of the lateral edge x of the frustum pyramid.

A) 1.5 cm
B) 4 cm
C) 3 cm
D) 5 cm




36. Find the volume of the water.




A) $108\pi\ cm^3$

B) $144\pi\ cm^3$

C) $72\pi\ cm^3$

D) $84\pi\ cm^3$

37. If $\begin{matrix} a+2b=1 \\ 2a-b=2 \end{matrix}$, then calculate $\dfrac{2a^2+3ab-2b^2}{\frac{a}{2}+b}$.

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

38. Find m. or

$$\begin{array}{r|l} x^6-x^4+x^2+m & x^2-1 \\ \hline - & B(x) \\ \hline 0 & \end{array}$$

or

$$\begin{array}{r|l} x^6-x^4+x^2+m & x^2-1 \\ \hline - & B(x) \\ \hline 0 & \end{array}$$

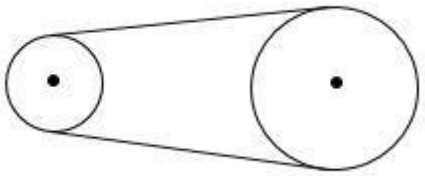
A) -2 B) -1 C) 0 D) 1

39. A rectangular box with a square base and an open top is to be constructed using 48 square meters of material. Find the maximum volume of the box in cubic meters.

A) 2 B) 4 C) 16 D) 32

40.

A belt snugly fit around the two wheels with radii $2-\sqrt{3}$ units and $5-\sqrt{3}$ units as in the figure. Their centers are 6 units apart. If $\pi$ is taken as 3, what is the length of the belt?



A) 20 units B) 22 units C) 24 units D) 26 units