

International
ONLINE Math Challenge

Online International Math Challenge

Past Papers 2021

Category Kids

Preface

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In 2020, aiming to encourage students to study and excel in math and critical thinking, the IMC team decided to conduct an online version of the International Math Challenge to boost the motivation of both teachers and students who have been bored, lost goal-oriented character, and stimulus for study under the difficult global pandemic times, when most of the Olympiads and competitions are forced to be canceled or postponed until unknown time. The IMC team also hoped this competition will help all types of schools to keep their students engaged and to observe their mathematics education in an international arena. The Online IMC 2020 witnessed the participation of 2000 students from 70 countries.

The next year, in 2021, the IMC Team cooperated with many institutions as well as universities from the different regions of the world. The competition was held in 5 languages and was participated in by more than 5000 students from 96 countries. The organizers and five university partners awarded 212 students from Category 4 with a total of more than 15 million USD as a scholarship.

Now, the IMC is the leading math competition in the world by the participating countries. The IMC 2022 will be even far-reaching with more surprises. This event is hoped to motivate students to see math in a different light, have their interest stimulated in the subject, and think about how they can apply math in their future studies and daily life.

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Warm Regards,

Chayanin Mhadla
General Secretary

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Category	US/Canada System	Thai System	British System	Russian System
Category kids	Grade 1	Prathom 1	Year 2	Grade 1
	Grade 2	Prathom 2	Year 3	Grade 2
Category 1	Grade 3	Prathom 3	Year 4	Grade 3
	Grade 4	Prathom 4	Year 5	Grade 4
Category 2	Grade 5	Prathom 5	Year 6	Grade 5
	Grade 6	Prathom 6	Year 7	Grade 6
Category 3	Grade 7	Matthayom 1	Year 8	Grade 7
	Grade 8	Matthayom 2	Year 9	Grade 8
Category 4	Grade 9	Matthayom 3	Year 10	Grade 9
	Grade 10	Matthayom 4	Year 11	Grade 10
Category 5	Grade 11	Matthayom 5	Year 12	Grade 11
	Grade 12	Matthayom 6	Year 13	Grade 12

Dates:

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Topics:

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Category Kids Topics

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Passwords, matching, number relations, figure relations, ordering ,paper cutting-folding, comparison, find different object, scales



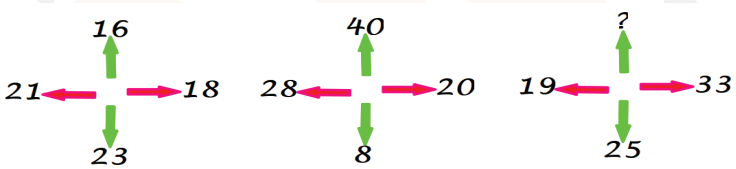
1. $467 \rightarrow 10, 11$
 $563 \rightarrow 11, 8$
 $874 \rightarrow 15, 12$
 $391 \rightarrow ?$

A) 10, 12

B) 12, 4

C) 12, 10

D) 4, 12

2. 

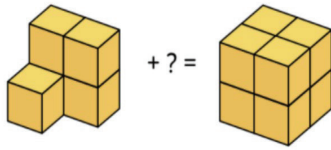
A) 27

B) 24

C) 18

D) 30

3.



A)



B)



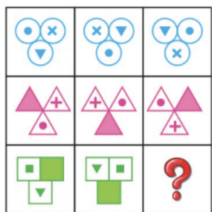
C)



D)



4.



A)



B)



C)



D)



5.

A) B)  C)  D)  

6. $684 \star = 342$ $246 \star = ?$
 $842 \star = 421$

A) 213

B) 321

C) 124

D) 123

7.



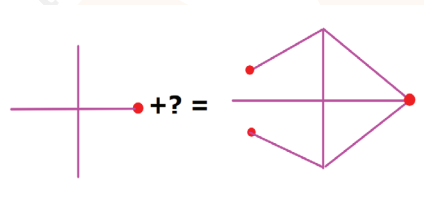
A) 46

B) 47

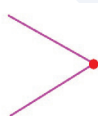
C) 44

D) 40

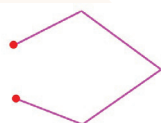
8.



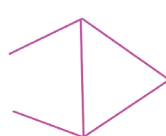
A)



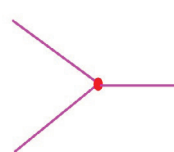
B)



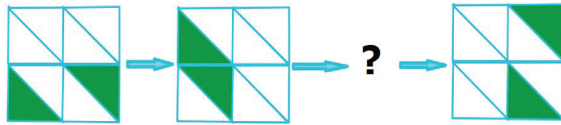
C)



D)



9.



A)



B)



C)



D)



10.

$$\begin{array}{r} 2 \triangle 3 \\ + \quad \blacksquare 4 1 \\ \hline 5 9 4 \end{array}$$

$$\triangle = ?$$

$$\blacksquare = ?$$

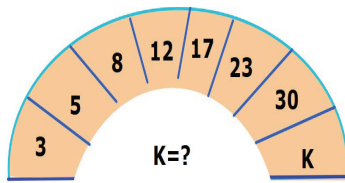
A) 4, 3

B) 3, 5

C) 5, 3

D) 3, 4

11.



A) 35

B) 38

C) 40

D) 42

12.

$$a \text{ 🐻 } b = (a + 3) - b$$

$$a \text{ 🐰 } b = (a + b) + 2$$

$$27 \text{ 🐰 } (12 \text{ 🐻 } 2) = ?$$

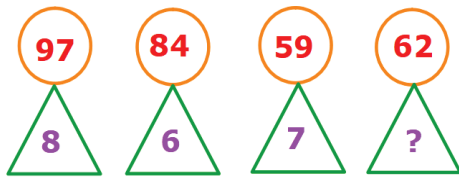
A) 42

B) 45

C) 50

D) 54

13.



A) 9

B) 6

C) 4

D) 2

14.

 **3247 = 7423**

 **4715 = 7154**

 **(4319) = ?**

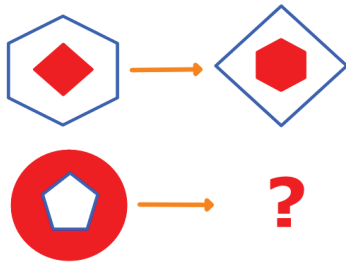
A) 4391

B) 3419

C) 9143

D) 1349

15.



A)



B)



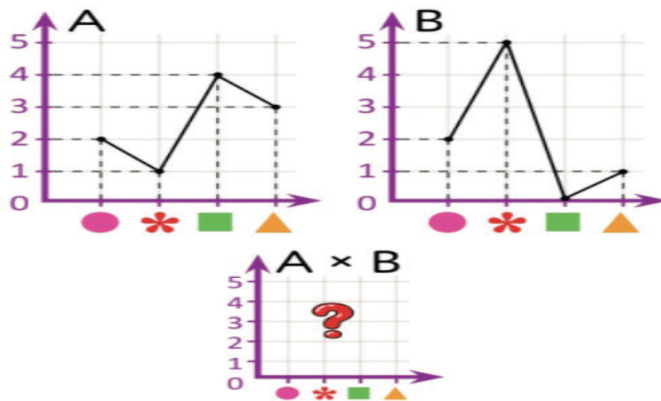
C)



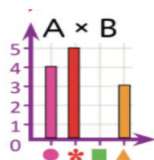
D)



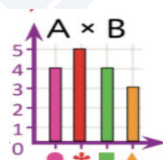
16.



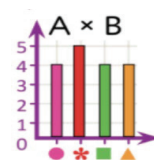
A)



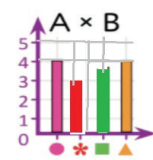
B)



C)



D)



17.

A	C	E
H	K	
	V	Z

 =?  =?

A) O, W

B) M, U

C) N, R

D) P, Y

18.



A)



B)



C)



D)



19.

NOVEMBER						
S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

A) 10

B) 11

C) 09

D) 12

20.

A, D, H, M, _

A) T

B) R

C) Q

D) S

21.

1	2	3	2
3	6	3	4
			
9	11	10	?

A) 13

B) 15

C) 12

D) 16

22.

A) 13

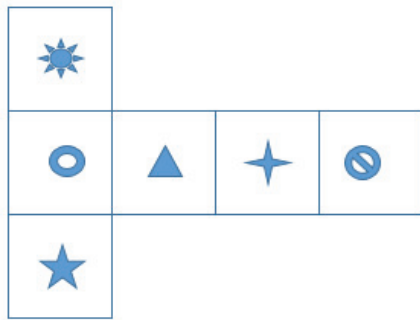
B) 15

C) 14

D) 12

?	N
21	U
13	M
2	B
5	E
18	R

23.



A)



B)



C)



D)



24.

$$\begin{array}{r}
 74 \triangle \\
 - 1 \blacksquare 9 \\
 \hline
 576
 \end{array}
 \quad
 \begin{array}{l}
 \triangle = ? \\
 \blacksquare = ?
 \end{array}$$

A) 5, 8

B) 8, 6

C) 5, 6

D) 6, 7

25. $12 - 11 + 10 - 9 + \dots - 5 = ?$

A) 0

B) 3

C) 5

D) 4

Online International Math Challenge

Answers:

1. B) 12, 4 2. A) 27 3. D)  4. A)  5. C)  6. D) 123 7. C) 44
8. B)  9. D)  10. C) 5,3 11. B) 38 12. A) 42 13. C) 4 14. D) 1349
15. A)  16. A)  17. C) N, R 18. A)  19. B) 11 20. D) S
21. C) 12 22. C) 14 23. A)  24. C) 5, 6 25. D) 4



ONLINE

International

M^{ath} Challenge

Only challengers can make a change!

International Math Challenge

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Category 1

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Operations and Properties	Estimating with whole numbers; divide multi-digit whole numbers, order of operations
Introduction to Algebra	Variables and expressions, first degree equations and their solutions
Fractions and Decimals	Operations in fractions and decimals, mixed numbers, solving fraction and decimal equations, comparing and ordering fractions
Number Theory	Factors
Data Collection and Analysis	Mean, median, mode and range, variation, frequency, tables, histograms, box-and-whisker plots
Ratio	Ratio
Measurement and Geometry	Area of rectangles, parallelograms, triangles and trapezoids
Mental Math and Brain Teasers	Age/level appropriate analytical and critical thinking questions



1. Calculate: $36 \times 11 + 24 \times 11 - 20 \times 11$.

A) 440

B) 520

C) 760

D) 880

2. Trees are planted equally on the two side of Walk Street. The distance between the two trees is 4 meters. If Walk Street is 300 m long. How many trees are along the street?

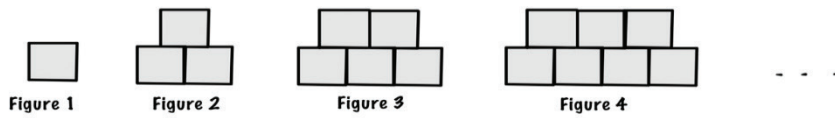
A) 75

B) 76

C) 150

D) 152

3. The pattern is given in the diagram below, if the pattern is continuing infinitely, how many squares does figure 11 has?



A) 19

B) 21

C) 23

D) 25

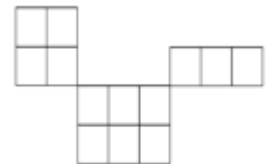
4. If the one side of square is x cm where x is 1-digit integer number. Find the highest value of the sum of the perimeter of the figure below.

A) 208

B) 214

C) 234

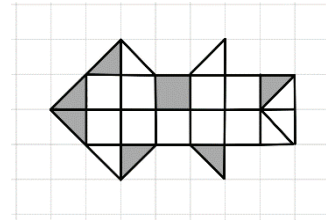
D) 248



Figure

5. What fraction is shaded area of shape?

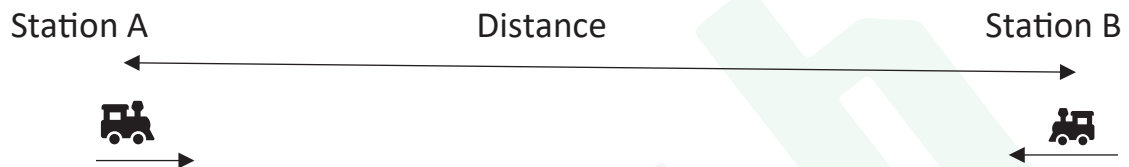
- A) 25% B) 50% C) 60% D) 20%



6. $9A7B$ is a 4-digit number that is divisible by 10. Find the highest value of $A+B$.

- A) 7 B) 9 C) 12 D) 15

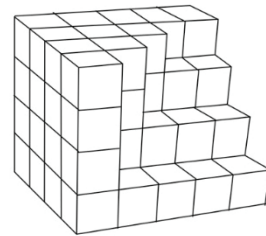
7. A train leaves from the station A with 280 km/h. After 2 hours, another train leaves from the station B with 300 km/h in the opposite direction. They meet each other in 3 hours after the first train leaving. What is the total distance between the two stations?



- A) 580 km B) 840 km C) 1040 km D) 1140 km

8. How many cubes are missing on the figure?

- A) 9 B) 12 C) 20 D) 24



9. 4 students planted 12 flowers in 10 minutes. If 16 students plant together, how many minutes will they finish for 24 flowers?

- A) 3 B) 5 C) 8 D) 10

10. George's father is 6 times older than George and George is twice as old as his sister Alice. In 5 years time, the sum of their ages will be 60. How old is George now?

- A) 3 B) 6 C) 9 D) 12

11. A bakery shop sells bread during the week. The owner keeps the selling records for each day. Use this information in the table below to find the mean.

A) 75

B) 65

C) 60

D) 55

Selling Records	
Days	Frequency
Monday	57
Tuesday	48
Wednesday	50
Thursday	60
Friday	45
Saturday	70
Sunday	90

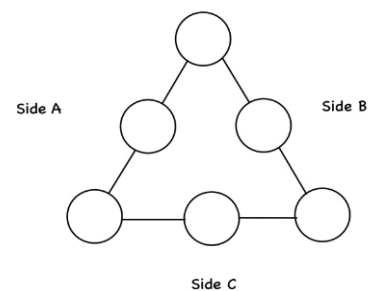
12. The numbers 1, 2, 3, 4, 5 and 6 are placed for each circle in the diagram. The sum of the numbers for each side is 9. What is the highest number at the top of the diagram?

A) 3

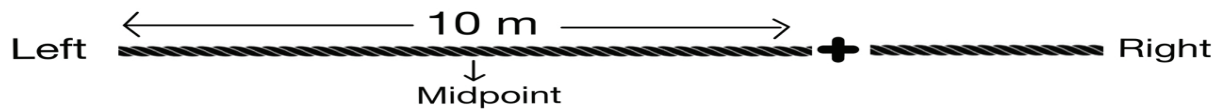
B) 4

C) 5

D) 6



13. A rope of 10 meters long is given. Another rope is adding as much as $\frac{3}{5}$ of the first rope. Where does the new midpoint slide?



- A) 1 m to left B) 1m to right. C) 3m to left. D) 3m to right.

14. Each icon represents different operation signs in the diagram.

When $x = 9$, $y = 6$ and $z = 3$, find the value of expression

$$[(18 \otimes x) \oplus (y @ 4)] + z.$$

- A) 9 B) 18 C) 27 D) 57

Diagram

$$9 \oplus 4 = 36$$

$$63 + 9 = 7$$

$$4 @ 3 = 1$$

$$12 \otimes 8 = 20$$

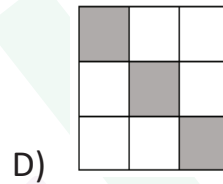
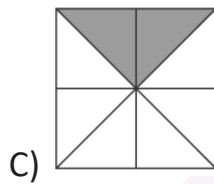
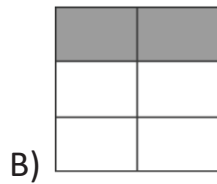
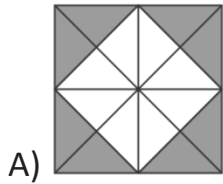
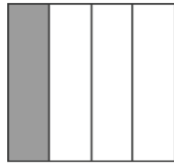
15. Julia read a book in 20 days. She read 8 pages every day for the first 10 days. Julia has read 1 page more each day than the previous day for the last 10 days. What is the total page of the book?

- A) 180 B) 198 C) 215 D) 236

16. Richard is saving money for a new book. On the first day, he put \$1.00 into the moneybox. On the second day, he added \$2.00 more than the first day. On the third day, he added \$2.00 more than the on the second day. If he continues adding \$2.00 more than the previous day, how much will he put to his moneybox on the tenth day?

- A) \$13 B) \$15 C) \$17 D) \$19

17. Look at the picture below. Which one of the following shows the same fraction shaded?



18. Find the sum of all the even numbers between 45 and 54.

A) 196

B) 250

C) 144

D) 150

19. The smallest 5 digit number that can be formed by using digits 6, 7, 3, 5, 8 is ____.

A) 67368

B) 35876

C) 53678

D) 35678

20. The difference between the smallest 7 digit number and the largest 5 digit number is ____.

A) 9000001

B) 900001

C) 90001

D) 9001

21. In all, there are _____ 5-digit whole numbers in the number system.

A) 90000

B) 9000

C) 900000

D) 900

22. The sum of two numbers is 3174. If one of the numbers is twice the other number, what is the difference between those numbers?

A) 1058

B) 2116

C) 1174

D) 2174

23. Jane ordered 2 pizzas, 2 burgers, 4 sodas, and 5 boxes of fries. If the cost of one pizza, one burger, one soda and one box of fries is \$10, \$21, \$14, and \$16 respectively, then what is the total amount Jane paid?

A) 981

B) 819

C) 189

D) 198

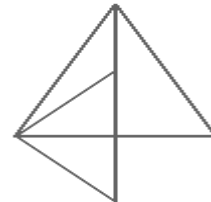
24. How many triangles are there in the given figure?

A) 9

B) 6

C) 7

D) 8



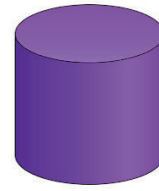
25. A cylinder has ____ edges.

A) 0

B) 1

C) 2

D) 3



26. A teacher gave a rectangular coloring sheet to each of his students. The sheet is 15 cm long and 8 cm wide. The area and perimeter of the sheet is ____cm² and ____cm respectively.

A) 110 cm² , 26 cm

B) 120 cm² , 66 cm

C) 120 cm² , 46 cm

D) 110 cm² , 46 cm



27. What is the half of $3^3 + 3^3 + 3^3 + 3^3 + 3^3 + 3^3$?

A) 27

B) 54

C) 81

D) 162

28. What is the question mark (?) in the below table?

A) 

B) 

C) 

D) 

29. Which number should come in place of the question mark?

A) 80

B) 48

C) 36

D) 20

	→ SQUARE →	24
	→ STAR →	40
	→ HEXAGON →	42
	→ RECTANGLE →	?

30. One ice cream is given free for children who bring four Popsicle sticks. How many free ice creams does a child get after buying 24 ice creams from the market?

A) 8

B) 7

C) 6

D) 5

31. How many's ♥ are equal to 🎸 ?

- A) 2 B) 4 C) 6 D) 8

$$\heartsuit + \heartsuit = \text{♪}$$

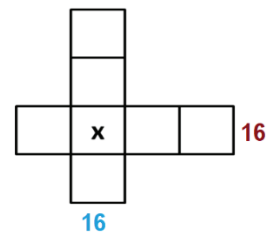
$$\text{♪} + \heartsuit = \star$$

$$\text{🎸} = \heartsuit + \text{♪} + \star$$

32. The numbers 1, 2, 3, 4, 5, 6 and 9 are placed to each square, in this diagram.

Sum of the four numbers in the horizontal row and vertical column both are 16 as shown in the picture. Find the value of x ?

- A) 2 B) 4 C) 6 D) 5



33. The word **Mathchallenge** is written repetitively like this:

MathchallengeMathchallengeMathchallenge... . What is the 1000th letter?

A) m

B) e

C) n

D) g

34.

$$\begin{array}{rcl} \star + \star + \star & = & 21 \\ \blacktriangle + \blacktriangle + \star & = & 23 \\ \blacksquare + \blacktriangle + \blacksquare & = & 26 \\ \blacktriangle + \star + \blacksquare & = & ? \end{array}$$

A) 23

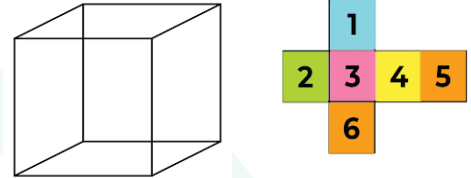
B) 26

C) 25

D) 24

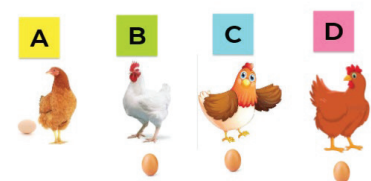
35. Benny opens the box and sticks colorful numbers to all faces as shown below. Later she folds the net back in a way that all the numbers remain outside the box. Which three numbers at the bottom have a common corner?

- A) 1, 2, 4 B) 2, 4, 6 C) 1, 3, 5 D) 1, 2, 5



36. Billy has four chickens labeled as A, B, C, D. A lays an egg every day, B lays an egg once every two days, C lays an egg once every three days, D lays an egg once every four days. If he needs to fill a box of 50 eggs to sell, how many days does he need to fill the box?

- A) 20 B) 24 C) 28 D) 32



37. Jane decides to play a kind of FLAME game to choose her favorite letter. The rule is starting from letter A, she will cross every 4th letter. If she continues the crossing until only one letter will remain on the circle, what will be the last letter?

A) U

B) V

C) X

D) Y



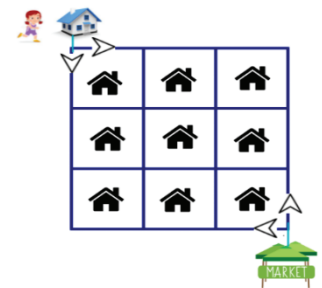
38. Kate has a 4×4 road grid between her home and market. The 1st day she decides to use a different route for each time she goes to market until she finishes all different ways. Considering she goes to market every day, on which day she must use an old route? (She always moves forward)

A) 18

B) 19

C) 20

D) 21



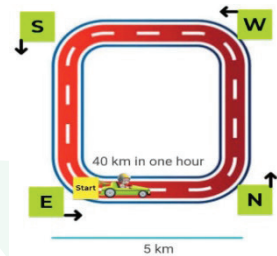
39. Jack drives a car 40 kilometers each hour around a square shaped road. If he started from the start sign and travelled 3 hours, what would be his direction when he stopped his car?

A) W

B) N

C) E

D) S



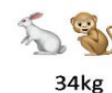
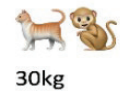
40. Calculate the total mass of rabbit, monkey and the cat.

A) 34

B) 35

C) 36

D) 37



Answers:

1. A) 440 2. D) 152 3. B) 21 4. C) 234 5. A) 25% 6. B) 9 7. D) 1140 km 8. C) 20
9. B) 5 10. B) 6 11. C) 60 12. A) 3 13. D) 3 m to right 14. B) 18 15. C) 215
16. D) \$19 17. C)  18. A) 196 19. D) 35678 20. B) 900001 21. A) 90000
22. A) 1058 23. D) 198 24. D) 8 25. C) 2 26. C) 120 cm², 46 cm 27. C) 81
28. A)  29. C) 36 30. C) 6 31. C) 6 32. A) 2 33. D) g 34. D) 24 35. D) 1, 2, 5
36. B) 24 37. A) U 38. D) 21 39. C) E 40. D) 37



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International Math Challenge

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Online International Math Challenge

Past Papers 2021

Category 2

Preface

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Category	US/Canada System	Thai System	British System	Russian System
Category kids	Grade 1	Prathom 1	Year 2	Grade 1
	Grade 2	Prathom 2	Year 3	Grade 2
Category 1	Grade 3	Prathom 3	Year 4	Grade 3
	Grade 4	Prathom 4	Year 5	Grade 4
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	Grade 6	Prathom 6	Year 7	Grade 6
Category 3	Grade 7	Matthayom 1	Year 8	Grade 7
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Topics:

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Category 2 Topics

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Graphs	The coordinate plane, interpreting graphs, slope and rate of change, direct variation
Measurement and Geometry	Angles, line and angle relationship, angles in polygons, area of rectangles, parallelograms, triangles and trapezoids, perimeters
Probability	Sample space, finding probability of dependent and independent events
Mental Math and Brain Teasers	Age/level appropriate analytical and critical thinking questions
Data collection and analysis	Mean, median, mode and range, frequency tables, histograms
Ratio and Proportion	Ratio, proportion, similarity of triangles and polygons
Operations and Properties & Introduction to Algebra	Order of operations including exponents, properties of numbers. Variables and expressions, solving first degree equations with variables on both sides
Integers and Rational Numbers, Decimals and Percentage	Operations in integers, solving equations containing integers, equivalent fractions and ordering rational numbers, four operations in fractions with like, unlike and mixed numbers and in decimals. Solving equations containing fractions, percentage of change, simple interest



1. If $A=2+3-2\times 3$, $B=1^2+3^2-(2-3)$, $C=(2-3)^2+4:2^2$, calculate $A+B\times C$.

A) 21

B) 23

C) 28

D) 34

2. If $a = x + 2$, $b = x - 3$, then what is the simplified form of $\frac{1}{a} - \frac{1}{b} + \frac{1}{ab}$?

A) $\frac{2x}{x^2-x-6}$

B) $\frac{1}{x^2-x-6}$

C) $\frac{-4}{x^2-x-6}$

D) $\frac{4}{x^2-x-6}$

3. Calculate: $2021^2 - 2 \times 2021 \times 2023 + 2023^2$.

A) -4

B) 4

C) -2023

D) 2023

4. If $\diamond$ is defined as $\alpha \diamond \beta = 3\alpha + \beta - 1$, then solve for x $x \diamond (2x - 1) = (2x - 1) \diamond x$.

A) -3

B) -1

C) 0

D) 1

5. Given that $a + b = c$ and $c = 2a - b$. If $a = 4$, then calculate the value of $c^2 - b^2$.

A) 4

B) 8

C) 16

D) 32

6. Calculate: $1 + 2 - 3 + 4 + 5 - 6 + 7 + 8 - 9 + \dots + 28 + 29 - 30$.

A) 135

B) 140

C) 145

D) 150

7. For a product 20 % discount applied over selling price. Later, x% discount applied over the new price. If the final price is the same as a discount of 24% over original selling price, find x.

A) 3

B) 4

C) 5

D) 6

8. Order the followings in an ascending order: 13 %, $\frac{4}{27}$, 0.15, $\frac{5}{28}$.

A) 13 %, $\frac{4}{27}$, 0.15, $\frac{5}{28}$

B) 13 %, $\frac{4}{27}$, $\frac{5}{28}$, 0.15

C) $\frac{4}{27}$, 13%, $\frac{5}{28}$, 0.15

D) $\frac{4}{27}$, 13 %, 0.15, $\frac{5}{28}$

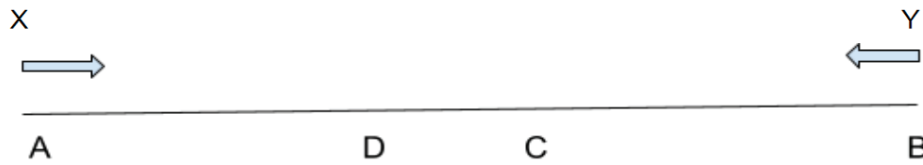
9. A teacher can distribute his candies equally among 11, 12 and 13 students and get extra 10 candies for himself each time. What is the minimum number of candies that a teacher has?

- A) 46 B) 1696 C) 1706 D) 1726

10. A student recorded his birthday as 01-11-2009 instead of 11-01-2009. If the true format is MM/DD/YYYY. By assuming each month has 31 days in a year, which of the followings is correct below according to recorded date?

- A) 330 days older B) 330 days younger
C) 320 days younger D) 320 days older

11.



X travels $\frac{2}{3}$ of AB and reaches C, Y travels $\frac{4}{7}$ of BA and reaches D. If $DC = 30$ km, $AB = ?$

A) 126 km

B) 147 km

C) 168 km

D) 189 km

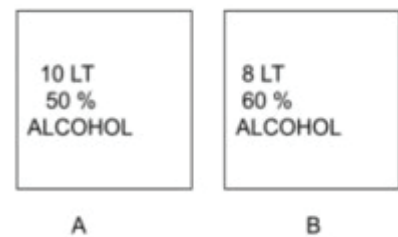
12. 2 liters of solution is taken from A to B. After it is mixed, half of mixture in B is moved back to A. What is the fraction of alcohol in A?

A) $\frac{69}{130}$

B) $\frac{67}{130}$

C) $\frac{65}{130}$

D) $\frac{63}{130}$



13. Calculate: $(1 + \frac{1}{2}) \times (1 + \frac{1}{3}) \times (1 + \frac{1}{4}) \times \dots \times (1 + \frac{1}{100})$.

A) 50

B) 50.5

C) 55

D) 55.5

14. A student writes all the numbers from 1 to 132 in 1 min. What is the average time to write one digit?

A) 8/19 s

B) 15/38 s

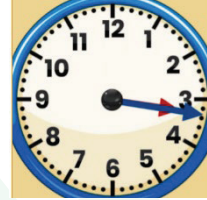
C) 3/14 s

D) 5/24 s

$[(18 \otimes x) \oplus (y @ 4)] + z$.

15. What is the exact time when the hour arm and minute arm overlap?

- A) 3h:16 min:2/11s B) 3h:16 min:3/11s
C) 3h:16 min:4/11s D) 3h:16 min:5/11s



16. x, y, z are integers, $x:y=2:3$, $y:z=4:5$, if $x+y+z < 200$, then find the maximum value of x .

- A) 40 B) 42 C) 44 D) 46

17. Internet package 1: 690 dollar instalment fee + 500 dollar fix rate for first 6 months. Then 50 dollar increase monthly. Package 2: Fix rate for whole time. If Package 1 equals Package 2 at the end of two years, then what is the monthly price for the second package?

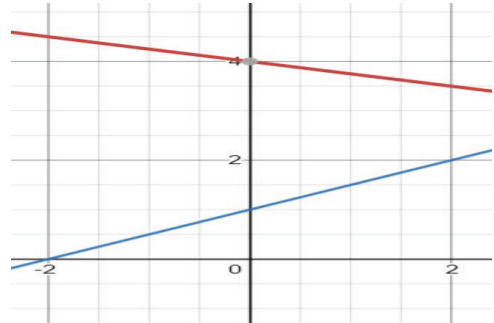
- A) 850 \$ B) 885 \$ C) 890 \$ D) 895 \$

18. If $\frac{A-B}{A+B} = \frac{2}{3}$, then find $\frac{A^2}{B^2}$.

- A) 1/5 B) 4/9 C) 4/6 D) 25

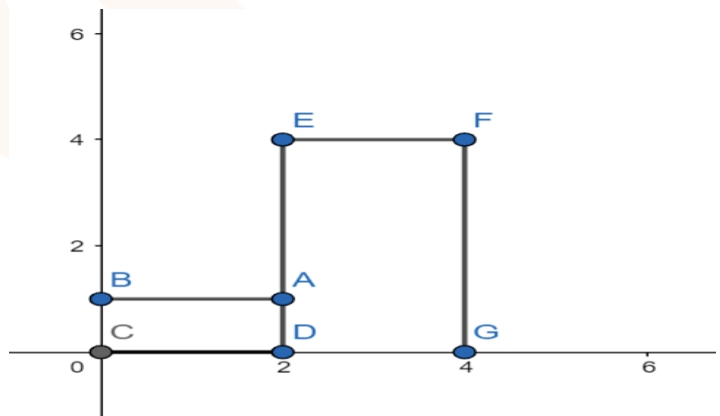
19. Two lines and their intersection points are given with a y-axis. If they meet at A (a, b), find $a + b$.

- A) 5.5 B) 6 C) 6.5 D) 7



20. In the shape ABCD is similar to DEFG. Find the slope of BF.

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



21. If A (1, 2), B (x, 4) and C (4-x, 7) are collinear points (points on the same line), find the value of x.

A) $9/5$

B) $5/3$

C) $11/7$

D) 2

22. A square ABCD is named counterclockwise in order A(0, 0), B(x, y), C(0, 12), D(w, z). What is the average of w, x, y, z?

A) 0

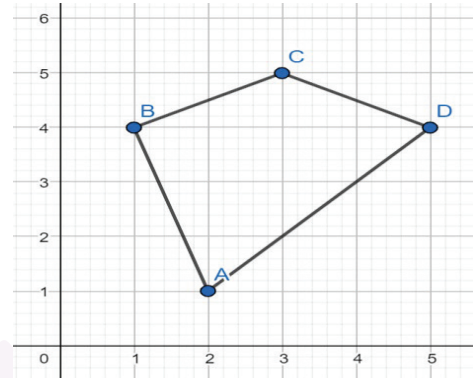
B) 1

C) 2

D) 3

23. Given A (2, 1), B (1, 4), C (3, 5), D (5, 4). What is the area of ABCD? (unit squares)

- A) 9 B) 8 C) 7.7 D) 7



24. Mean (average) of five numbers is 5. If the sum of the last three of these numbers is 21 what is the mean of the other two?

- A) 1 B) 2 C) 4 D) 5

25. Given set $\{3, 9, 2, 4, 3, 1, 3, 10, 1\}$. a, b, c, d are mode, mean, median and range, respectively for given data set. Which option is the correct set of a, b, c, d below?

A) $a=10, b=4, c=3, d=9$

B) $a=1, b=4, c=3, d=10$

C) $a=2, b=3, c=4, d=10$

D) $a=3, b=4, c=3, d=9$

26. To write all the numbers from 0 to 100, which digit is most frequently used?

A) 0

B) 1

C) 5

D) 9

27. For the different positive integers a, b, c, d . Their mean is 6.5. Three of them are perfect squares. None of them are prime numbers. What is the biggest one in the set?

A) 8

B) 10

C) 12

D) 14

28.



A long shopping bill is folded in the middle horizontally 4 times and then has a width less than its height. If x is an integer, what is the maximum possible area of the bill.

A) 390

B) 395

C) 400

D) 420

29. Find angle a , when it is 5:50 am.

A) 124°

B) 125°

C) 21°

D) 30°



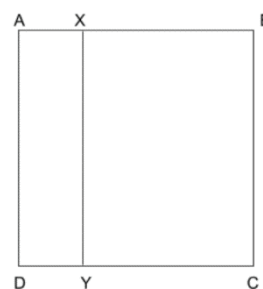
30. ABCD is a square. If $A(AXYD) = \frac{2}{7} A(XBCY)$, then what is $\frac{P(AXYD)}{P(XBCY)}$?

A) $\frac{11}{14}$

B) $\frac{11}{16}$

C) $\frac{4}{49}$

D) $\frac{2}{7}$



31. ABCD is a trapezium, where $AD \parallel BC$. $8 \times A(\triangle AED) = 3 \times A(\triangle BCE)$, and

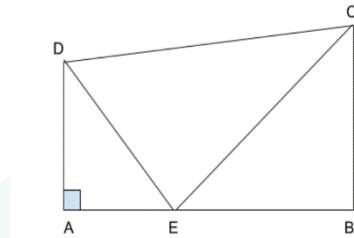
$5AD=3BC$, What is the $\frac{A(\triangle ABCD)}{A(\triangle CDE)}$?

A) $\frac{104}{49}$

B) $\frac{105}{50}$

C) $\frac{104}{55}$

D) $\frac{1}{2}$



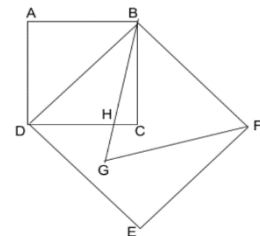
32. ABCD and BDEF are squares and BFG is an equilateral triangle. Find the angle BHD.

A) 100

B) 104

C) 105

D) 110

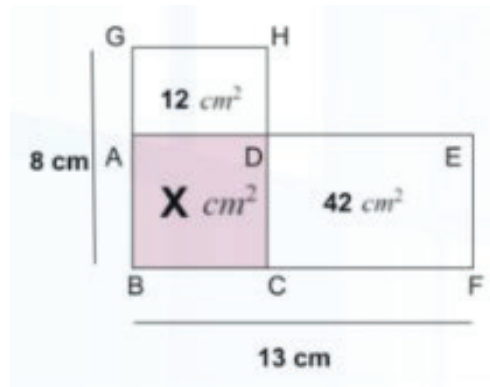


33. ABCD is a square.

BGHC and BFEA are rectangles.

Find the area of ABCD.

- A) 36 cm^2 B) 30 cm^2
C) 25 cm^2 D) 24 cm^2

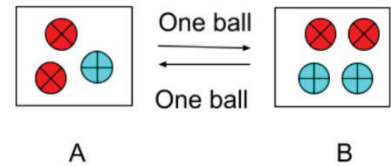


34. $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11\}$. A number is randomly chosen from set A. What is the probability of choosing an odd and prime number?

- A) $6/5$ B) $6/11$ C) $5/11$ D) $4/11$

35. At the same time one ball chosen from A and another ball chosen from B and they are switched between boxes. What is the probability of having the initial color ratio in the boxes after switching?

- A) $\frac{1}{2}$ B) $\frac{3}{7}$ C) $\frac{4}{7}$ D) $\frac{3}{4}$



36. $A = 1\frac{1}{2} + 0.25$, B is 25% of $(x - 2)$, $C = 1 + \frac{1}{1 - \frac{2}{3}}$. If $A + C$ is equal to B , find x .

- A) 30 B) 25 C) 23 D) 21

37. Calculate: $(1 - 2)^2 + (3 - 4)^2 + (5 - 6)^2 + \dots + (99 - 100)^2$.

A) -100

B) -50

C) 50

D) 100

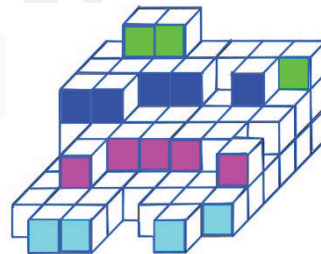
38. Find the number of the cubes in the picture.

A) 86

B) 87

C) 88

D) 89



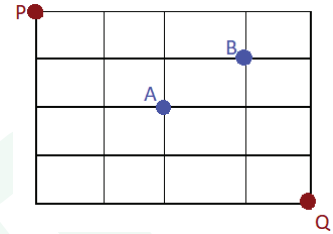
39. A mouse wants to go from P to Q. The points A and B are trapped. Using only right and down ways, how many safe ways are there for the mouse?

A) 15

B) 16

C) 17

D) 18



40. In a family there are 20 members and after 20 years time if everyone is still alive, which value is affected least for the age of members?

A) Mode

B) Median

C) Range

D) Mean

Answers:

1. A) 21 2. C) $\frac{-4}{x^2-x-6}$ 3. B) 4 4. D) 1 5. D) 32 6. A) 135 7. C) 5
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18. D) 25 19. D) 7 20. B) $\frac{3}{4}$ 21. C) $\frac{11}{7}$ 22. D) 3 23. B) 8 24. B) 2
25. D) a= 3, b = 4, c = 3 , d= 9 26. B) 1 27. C) 12 28. B) 395 29. B) 125° 30. B) $\frac{11}{16}$
31. A) $\frac{104}{49}$ 32. C) 105 33. A) 36 cm^2 34. D) $\frac{4}{11}$ 35. A) $\frac{1}{2}$ 36. B) 25 37. C) 50
38. C) 88 39. D) 18 40. C) Range



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Graphs and Functions	The coordinate plane, interpreting graphs, slopes and rate of change, graph of linear functions
Rational Numbers	Four operations in rational numbers with like, unlike denominators, solving first degree equations with rational numbers and expressions
Trigonometry	Sine, cosine, tangent ratios, sine and cosine rules, area of triangles
Circle Geometry	Arc and chord length, sector and segment areas, angles in circles, tangents to a circle
Mental Math and Brain Teasers	Age/level appropriate analytical and critical thinking questions
Exponents and Roots	Integer exponents, properties of exponents, operating with scientific notations, squares and square roots, estimating square roots, the real numbers and identifying irrational numbers, the Pythagorean theorem and its converse, finding distance on the coordinate plane
Measurement and Geometry	Angles, line and angle relationship in parallel and perpendicular lines, exterior angles in polygons, similarity and congruence transformations, combined transformations, perimeter and area, pi, area and circumference of circles, volume and surface area of prisms and cylinders, volume of pyramids, cones and spheres
Multi-step Equations of First Degree	Simplifying algebraic expressions, solving equations including variables on both sides, fractional expressions, distributive property, linear inequalities, systems of equations and inequalities of first degree
Quadratic Equations	Factorization, quadratic equations

1. If $a = 2021$, $b = |3a^2 - a + 3| - 3|a^2 + 1| + 11a + 1$, find b .

A) 20211

B) 20212

C) 1

D) 20209

2. If $x + y = 7$, $y + z = 5$ and $z + x = 10$, then find the value of $x \times y \times z$.

A) 12

B) 24

C) 30

D) 36

3. Find the sum of all positive factors of 120.

A) 360

B) 362

C) 344

D) 235

4. If $\cos \theta = \frac{3}{5}$ and $0 < \theta < 90^\circ$, find $\tan \theta - \frac{1}{\sin \theta}$.

A) $\frac{8}{15}$

B) $-\frac{8}{15}$

C) $-\frac{1}{12}$

D) $\frac{1}{12}$

5. Given $3 + \frac{2}{6 + \frac{2}{6 + \frac{2}{\ddots}}} = x$. Find x^2 .

A) 1

B) -1

C) $\sqrt{11}$

D) 11

6. If a and b are natural numbers and $\frac{1}{3a+b-5} + \frac{1}{a+3b-7} = 1$. What is $a + b$?

A) 2

B) 3

C) 4

D) 5

7. Given $w = \frac{4^x - 4^y}{2}$. If x is a 4-digit even number and y is 3-digit odd number, what is the last digit of w ?

A) 1

B) 2

C) 4

D) 6

8. Given $f(x) = x + 5$, $g(x) = 4 - x$. What is the area of the closed region between the lines and the x -axis?

A) 22.5

B) 22.25

C) 20.5

D) 20.25

9. a and n are natural numbers. If $(a \cdot 10^n)$ is the scientific representation of a 25 digit-natural number, what is the minimum difference of $n-a$?

A) 1

B) 5

C) 11

D) 15

10. Given $\frac{6^m+6^m+6^m}{3^m+3^m+3^m+3^m+3^m+3^m} = 64$. What is m ?

A) 3

B) 5

C) 7

D) 9

11. If $4xy = 5yz = 12xz$, which of the followings is inversely proportional to x, y, z respectively?

A) 4, 12, 15

B) 12, 5, 15

C) 4, 5, 12

D) 5, 12, 4

12. How many sides does a convex-polygon have if the sum of its interior and exterior angles is 1440?

A) 5

B) 7

C) 8

D) 10

13. A group of workers can finish a job in 39 days. If the number of workers are reduced by 25%, and the capacity of workers is increased by 30%. How many days will it take to finish the same job?

A) 39

B) 40

C) 42

D) 55

14. If a, b, c, d are positive integers, then what is the digit in the unit place of $1^a + 5^b + 6^c + 10^d$?

A) ...2

B) ...3

C) ...6

D) ...8

15. If $a + b + c = 0$, then what is the value of $a^2 - b^2 + ac - bc$?

A) a

B) ab

C) 0

D) $c + a$

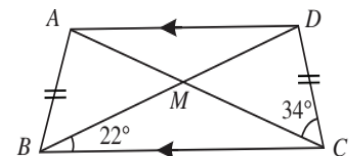
16. In the figure, $ABCD$ is an isosceles trapezoid. $AB = DC$, $AD \parallel BC$, $m(\angle DBC) = 22^\circ$ and $m(\angle ACD) = 34^\circ$. What is $m(\angle BAC)$?

A) 98°

B) 100°

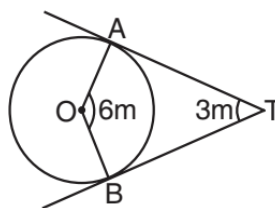
C) 102°

D) 104°



17. O is the center of circle. TA and TB are tangent to the circle. Find m .

- A) 20° B) 25° C) 30° D) 45°



18. Evaluate: $\frac{1}{\sqrt{25}+\sqrt{24}} + \frac{1}{\sqrt{24}+\sqrt{23}} + \frac{1}{\sqrt{23}+\sqrt{22}} + \dots + \frac{1}{\sqrt{2}+\sqrt{1}}$.

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

19. If $2.4545454\ldots = \frac{m}{n}$, where $\frac{m}{n}$ is in its simplest form, then find the value of $m - n$.

A) 14

B) 16

C) 18

D) 20

20. If $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \frac{7}{11}$, then find the value of $\frac{2a+3c+4e}{2b+3d+4f}$.

A) $\frac{4}{11}$ B) $\frac{7}{11}$ C) $\frac{14}{33}$ D) $\frac{35}{11}$

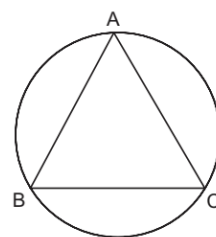
21. $\triangle ABC$ is equilateral triangle inscribed in a circle. Given that the radius of the circle is 6 cm , then what is the area of the triangle?

A) $27\sqrt{3}\text{ cm}^2$

B) $24\sqrt{3}\text{ cm}^2$

C) 18 cm^2

D) 12 cm^2



22. If $x^2 + y^2 = 3$, what is the maximum value of $2x + y^2$?

A) 6

B) 5

C) 4

D) 3

23. Let $x = 1 + \sqrt{3}$, find the value of $x^6 - 2x^5 - 4x^3 - 8x - 5$.

A) $-\sqrt{3}$

B) 9

C) 3

D) $3\sqrt{3}$

24. If $1^6 + 2^6 + 3^6 + 4^6 + 5^6$ is divided by 7, what is the remainder?

A) 2

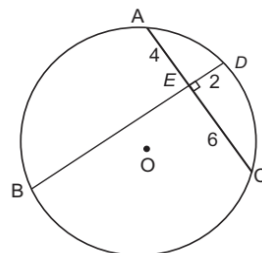
B) 3

C) 4

D) 5

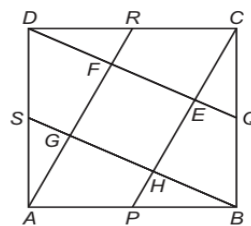
25. In the figure O is the center of the circle. $AC \perp BD$, $AE = 4$, $ED = 2$ and $EC = 6$. Find the radius of the circle.

- A) 7.5 B) $5\sqrt{2}$ C) $4\sqrt{3}$ D) $4\sqrt{13}$



26. In the figure $ABCD$ is a square. P, Q, R, S are the midpoints of AB, BC, CD and DA respectively. If $AB = 2\sqrt{5}$, then what is the length of EF ?

- A) 1 B) 2
C) $\sqrt{2}$ D) $\sqrt{5}$



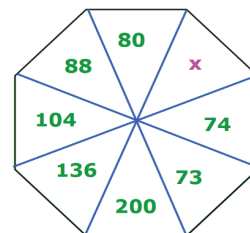
27. The numbers in the octagon are written according to a certain rule. According to this rule, find x.

A) 79

B) 77

C) 76

D) 73



28. Which number is the odd one out?

A) 7255

B) 5181

C) 168

D) 3100

7242	284
8271	4155
6239	7255
168	3100
4168	5181

29. Find the missing number.

A) 64

B) 48

C) 36

D) 32

8	2	4	16
10	2	5	25
6	3	9	18
12	4	16	?

30. Which number replaces the question mark?

$$706543 = 460$$

$$985476321 = ?$$

A) 380

B) 2456

C) 2648

D) 1258

31. If $CC, 2C, 121C, 21121C, \dots$. What comes next?

A) 12213C

B) 121C

C) 2131CC

D) 22311C

32. For the function $f(x) = \frac{k}{1+x^{2021}}$,

$$f(20) + f(19) + f(18) + \dots + f(1) + f\left(\frac{1}{2}\right) + f\left(\frac{1}{3}\right) + \dots + f\left(\frac{1}{19}\right) + f\left(\frac{1}{20}\right) = 78$$

is true. Find value of k .

A) 8

B) 6

C) 4

D) 2

33. Which of the functions does satisfy the following condition?

$$f^2(x) - 21 = x^2 + 4f(x) + 10x$$

A) $2x - 3$

B) $x + 7$

C) $3x^2 - 4$

D) $x + 4$

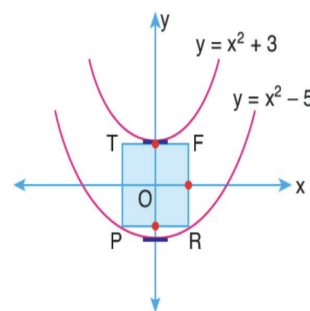
34. The graphs of two quadratic functions $y = x^2 - 5$ and $y = x^2 + 3$ are given (not to scale). PRFT is a square. What is the area of the square?

A) 4

B) 8

C) 12

D) 16



35. If every figure from column I represents one of the numbers from column II, then find what is 457.

<u>I</u>	<u>II</u>	
★ ■ ◆	534	
★ ◆ ■	873	457=?
■ ★ ◆	457	
◆ ◆ ★	385	

A) ★ ◆ ■

B) ■ ★ ◆

C) ◆ ◆ ★

D) ◆ ■ ◆

36.

$$\begin{array}{r}
 AA \\
 \times A \\
 \hline
 BB
 \end{array}
 \qquad
 \begin{array}{r}
 BC4 \\
 - 1BA \\
 \hline
 D61
 \end{array}$$

→ C=? ; D=?

A) 5, 7

B) 3, 6

C) 5, 8

D) 4, 7

37. I. $9 \div 6 = \frac{1}{36}$

II. $7 \div 3 = \frac{2}{21}$

III. $9 \div 4 = \frac{5}{72}$

Use the relationship between the numbers above to find the following statement.

$11 \div 9 = ?$

A) $\frac{7}{19}$

B) $\frac{4}{38}$

C) $\frac{1}{99}$

D) $\frac{34}{121}$

38. Line $y = mx + 2$ is tangent to the parabola $f(x) = x^2 + 2x + m$. Find the greatest value of the m .

A) 2

B) 6

C) 12

D) 18

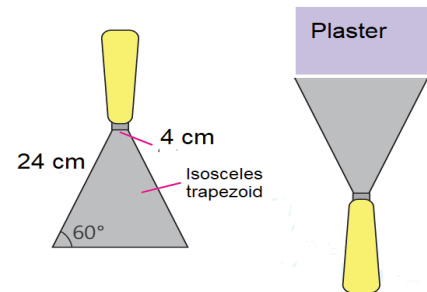
39. Plastering is overlaid on the wall with the construction tool below. The plastering part of the tool is the isosceles trapezoid. Accordingly, how wide is the plaster made?

A) 24 cm

B) 28 cm

C) 30 cm

D) 32 cm



40. If $\frac{A}{B} = \frac{4}{5}$, $\frac{B}{C} = \frac{7}{9}$ and $\frac{C}{D} = \frac{25}{28}$, then find what is $\frac{A}{D}$.

A) $\frac{4}{5}$

B) $\frac{5}{7}$

C) $\frac{5}{9}$

D) $\frac{28}{45}$

Answers:

1. A) 20211 2. B) 24 3. A) 360 4. D) $\frac{1}{12}$ 5. D) 11 6. D) 5 7. A) 1 8. D) 20.25 9. D) 15
10. C) 7 11. B) 12, 5, 15 12. C) 8 13. B) 40 14. A) ...2 15. C) 0 16. C) 102° 17. A) 20°
18. B) 4 19. B) 16 20. B) $\frac{7}{11}$ 21. A) $27\sqrt{3} \text{ cm}^2$ 22. C) 4 23. C) 3 24. D) 5 25. B) $5\sqrt{2}$
26. B) 2 27. C) 76 28. B) 5181 29. B) 48 30. C) 2648 31. D) 22311C 32. C) 4
33. B) $x + 7$ 34. D) 16 35. D) ✨🔴🌟 36. A) 5, 7 37. C) $\frac{1}{99}$ 38. B) 6 39. B) 28 cm
40. C) $\frac{5}{9}$



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Past Papers 2021

Category 4

Preface

International Math Challenge (IMC) is one of the leading mathematics-based international competitions in the world aimed at school students of various grades. As an IMC team, we believe that current problems around the globe can be solved through critical thinking and cooperation among the next generation of skilled challengers. The first Math Challenge was organized in 2012 as an inter-school competition among international schools in Bangkok with the participation of 144 students from 10 schools. Gradually the number of participants increased and in 2014 Math Challenge went beyond the Thailand borders and started hosting international participants. IMC IX witnessed the participation of 800 students from 20 countries in 2020.

In 2020, aiming to encourage students to study and excel in math and critical thinking, the IMC team decided to conduct an online version of the International Math Challenge to boost the motivation of both teachers and students who have been bored, lost goal-oriented character, and stimulus for study under the difficult global pandemic times, when most of the Olympiads and competitions are forced to be canceled or postponed until unknown time. The IMC team also hoped this competition will help all types of schools to keep their students engaged and to observe their mathematics education in an international arena. The Online IMC 2020 witnessed the participation of 2000 students from 70 countries.

The next year, in 2021, the IMC Team cooperated with many institutions as well as universities from the different regions of the world. The competition was held in 5 languages and was participated in by more than 5000 students from 96 countries. The organizers and five university partners awarded 212 students from Category 4 with a total of more than 15 million USD as a scholarship.

Now, the IMC is the leading math competition in the world by the participating countries. The IMC 2022 will be even far-reaching with more surprises. This event is hoped to motivate students to see math in a different light, have their interest stimulated in the subject, and think about how they can apply math in their future studies and daily life.

We wish the best to all students and their mathematics mentors/trainers. We hope our youth will be inspired to think critically and scientifically by the love of mathematics and technology. We look forward to welcoming you all to the next competition days.

Warm Regards,

Chayanin Mhadla
General Secretary

Competition details:

The Online International Math Challenge is open to all students from all grades. Students can participate under their relevant categories.

Category	US/Canada System	Thai System	British System	Russian System
Category kids	Grade 1	Prathom 1	Year 2	Grade 1
	Grade 2	Prathom 2	Year 3	Grade 2
Category 1	Grade 3	Prathom 3	Year 4	Grade 3
	Grade 4	Prathom 4	Year 5	Grade 4
Category 2	Grade 5	Prathom 5	Year 6	Grade 5
	Grade 6	Prathom 6	Year 7	Grade 6
Category 3	Grade 7	Matthayom 1	Year 8	Grade 7
	Grade 8	Matthayom 2	Year 9	Grade 8
Category 4	Grade 9	Matthayom 3	Year 10	Grade 9
	Grade 10	Matthayom 4	Year 11	Grade 10
Category 5	Grade 11	Matthayom 5	Year 12	Grade 11
	Grade 12	Matthayom 6	Year 13	Grade 12

Dates:

Registration dates: 15 August – 30 October 2022

Competition date: 11-12 November 2022

Results Announcement: 15 November 2022

Awarding Ceremony: 30 November 2022

Exam rules:

The exam will be online in English, Thai, Chinese, Russian, and Spanish.

There will be 25 multiple choice questions for category kids, and 40 questions for all other categories.

3 wrong answers will void 1 correct answer.

Students will be receiving individual awards.

Certificates will be issued to all participants, mentors, and schools.

More information at <https://mathchallenge.in.th/online/>

For any questions, please contact register@mathchallenge.in.th

Topics:

Please see the updated topics at <https://mathchallenge.in.th/online/>

Category 4 Topics

Kindly note that this is the topics for the Online IMC 2021. For the updated topics, please visit our website.

Sets Theory	Sets and their representations, practical problems based on sets
Sequences and Series	Arithmetic sequences and series, the general term of an arithmetic sequence, sum of n terms of an arithmetic sequence, Arithmetic Mean (A.M.), geometric sequences and series
Trigonometry	Pythagoras' theorem(review), right angled triangle trigonometry, finding sides and angles, problem-solving using trigonometry, radian measure and periodic properties of circles, the unit circle, the basic trigonometric ratios, the equation of a straight line, areas of triangles
Probability and Statistics	Types of data, grouped data, organization, and display of numerical data, cumulative frequency tables and graphs, measuring the central tendency of data, measuring the spread of data, outliers, standard deviation, scatter plots, correlation, line of best fit. interpolation, extrapolation
Plane and Space Geometry	Cartesian plane, ordered pairs, slope of a line and angle between two lines, equation of family of lines passing through the point of intersection of two lines, standard equations and simple properties of parabola, ellipse and hyperbola. Standard equation of a circle
Relations and Functions	Ordered pairs, Cartesian product of sets, number of elements in the Cartesian product of two finite sets, Cartesian product of the sets of real numbers, definition of relation, pictorial diagrams, domain, co-domain and range of a relation, pictorial representation of a function, domain, co-domain and range of a function
Logarithmic and Exponential Forms, Radical Expressions and Equations	Index notations, evaluating powers, index laws, rational indices, algebraic expansion and factorization, exponential equations, graphs of exponential functions, the natural exponential "e", logarithms, logarithms in base 10, laws of logarithms
Mental Math and Brain Teasers	Analytical and critical thinking questions

1. In a class, every student likes to play either volleyball or badminton. There are 7 students who like to play volleyball, 9 students who like to play badminton, and 4 students like to play both. How many students are there in that class?

A) 20

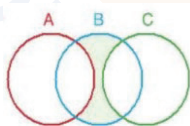
B) 16

C) 12

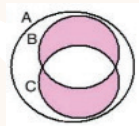
D) 2

2. Which of the following represents $(A \cap B \cap C) \cup (C \setminus (A \cup B))$?

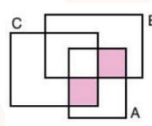
A)



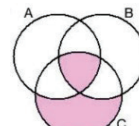
B)



C)



D)



3. $2 \log_3 27 + \log_3 3$ can be simplified as

A) 9

B) 7

C) 4

D) 2

4. Given that $2^x=3$, $3^y=4$, and $4^z=5$. What is the value of 2^{xyz+1} ?

A) 0

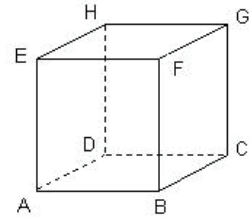
B) 2

C) 5

D) 10

5. In an ABCDEFGH cube with edges of 4cm and P is the midpoint of FG, what is the shortest distance between P and AH?

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



6. A right triangle with side a, b, c forming an arithmetic sequence. The perimeter of that triangle is p cm and its area is q cm². Given that $3p = 2q$, what is the value of b ?

- A) 12 B) 10 C) 9 D) 8

7. Given a geometric sequence with $a_5 = 100$ and $a_{10} = \frac{25}{8}$. What is the value of a_2 ?

A) 700

B) 800

C) 900

D) 1000

8. A group of 10 people has an average weight of 70.1 kg. Two people with the same weight are added into that group and the average changed into 71.75 kg. What is the weight of those additional people?

A) 70 kg

B) 75 kg

C) 80 kg

D) 85 kg

9. A box contains 10 light bulbs. Three of those light bulbs are defected. If 3 light bulbs are taken, what is the probability of getting exactly one defected light bulb?

A) $\frac{32}{40}$

B) $\frac{21}{40}$

C) $\frac{18}{40}$

D) $\frac{15}{40}$

10. Given that $f(x) = \frac{1}{\sqrt{2x+1}}$ and g is the inverse of f , what is the value of $g(5)$?

A) $-\frac{12}{25}$

B) $\frac{13}{25}$

C) $-\frac{14}{25}$

D) $-\frac{16}{25}$

11. Given that lines $(a + b)x + 2by = 2$ and $ax - (b - 3a)y = -4$ intersect at $(1, -1)$, what is the value of $a + b$?

A) 2

B) -2

C) 0

D) 1

12. There is a relationship between numbers written into large squares and numbers in small squares. Find A.

A) 12

B) 10

C) 9

D) 8

12	22	8	10
15	7	5	7
24	A	9	43
27	13	14	24

13. The square on the right is formed by a certain rule. Which of the below squares is not formed by the same rule?

2	7	6
9	5	1
4	3	8

A)

2	9	4
7	5	3
6	1	8

B)

4	9	2
3	5	7
8	1	6

C)

3	5	7
8	1	6
4	9	2

D)

8	1	6
3	5	7
4	9	2

14. The four-digit numbers that are given below will be placed in 4x4 table horizontally and vertically, where each cell contains a digit. Hence, what is the value of $A+B-C$?

A) 4

B) 5

C) 7

D) 9

		A	
B			
			C
	2		

5827	7319	5428	8259
2461	2165	4513	8542

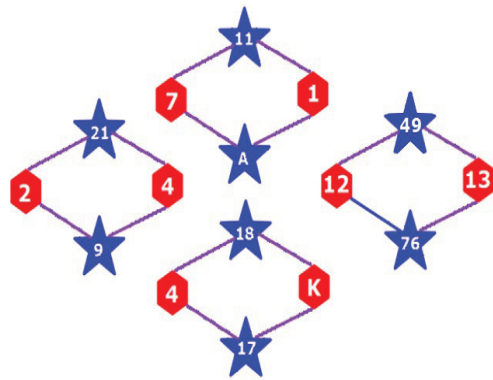
15. There is a relation between given numbers in the diagrams, then find the value of $(K+A)$.

A) 44

B) 40

C) 36

D) 32



16. The number sequence above is formed according to a certain rule. Find $(x+y)$.



A) 24

B) 26

C) 28

D) 30

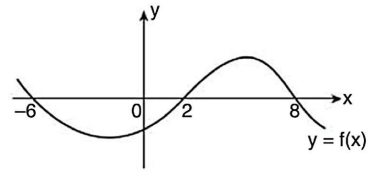
17. $f: [-6, 8] \rightarrow \mathbb{R}$ is given. At how many points will the graph of $f(x)$ and $f(x-3)$ intersect each other?

A) 4

B) 3

C) 2

D) 1



18. A palindromic number is a number that remains the same when its digits are reversed. For example: 1235321, 212, 23732 ..., 5554555... . Then how many seven-digit palindromic numbers can be generated?

A) 900

B) 9000

C) 10000

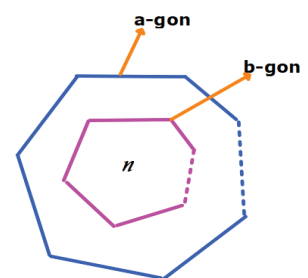
D) 12000

19. A student solved 20, 12, 14, 16, 18 questions during a week. What is the standard deviation of the number of questions solved?

- A) 3.14 B) 3.15 C) 3.16 D) 3.17

20. The above symbol represents the n^{th} term of an arithmetic sequence where its first term is a and its common difference is b . What is the value of x satisfying the following equation?

$$\boxed{4} + \boxed{6} = \boxed{x}$$



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

21. Given $ax^2 + bx + c = 0$. α, β are its roots where $\alpha + \beta, 1, \alpha \times \beta, \dots$ forms an arithmetic sequence. Find the value of $\frac{c-b}{a}$.

A) 4

B) 3

C) 2.5

D) 2

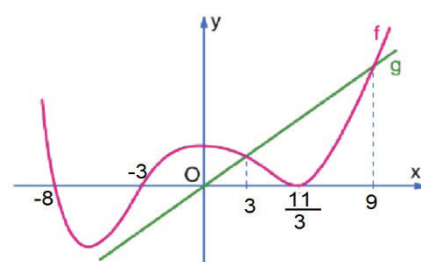
22. The graphs of functions $f(x)$ and $g(x)$ are given. By using the graph find how many terms of sequence $a_n = \left(\frac{f(n)-g(n)}{f(n)}\right)$ are negative?

A) 8

B) 7

C) 5

D) 4



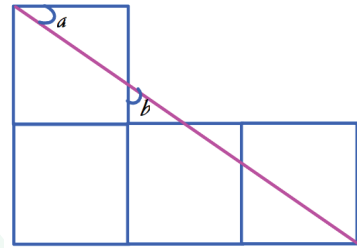
23. The above figure is formed by unit squares. Calculate $(\tan a + \tan b)$.

A) $\frac{13}{6}$

B) 5

C) $\frac{4}{3}$

D) $\frac{11}{6}$



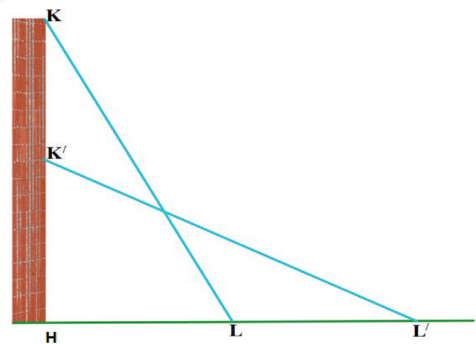
24. The bar KL with a length of 10 m is attached to the wall at a 30° angle. Later the same bar is re-attached to the wall at the 60° angle. Find the length of LL' .

A) 5

B) $5\sqrt{6}$

C) $5\sqrt{3} - 5$

D) $5\sqrt{6} - 5\sqrt{2}$



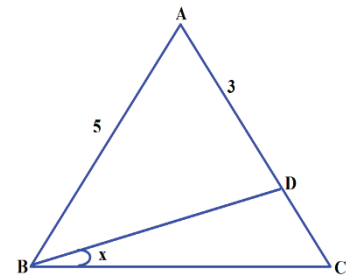
25. ABC is an equilateral triangle. If $|AB| = 5\text{ cm}$, $|AD| = 3\text{ cm}$, then find value of $\tan x$.

A) $\frac{2\sqrt{3}}{5}$

B) $\frac{\sqrt{3}}{5}$

C) $\frac{\sqrt{3}}{2}$

D) $\frac{\sqrt{3}}{4}$



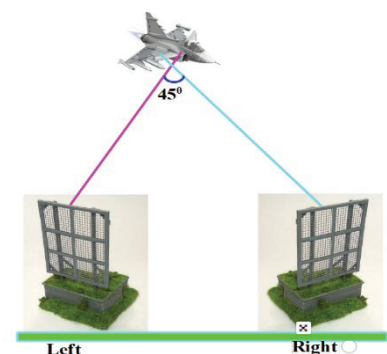
26. Radar beams are sent from 2 radar stations with a distance of 2600 m to capture enemy aircraft which is directly above the radars. The tangent of the angle of the beam sent from the left radar station with the plane is 5. When the beams make a 45-degree angle in the sky, the plane is located. If the height of the radar stations are 50 m, determine the ground height of the aircraft.

A) 3050 m

B) 2750 m

C) 3750 m

D) 2900 m



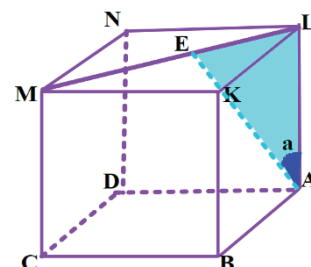
27. A unit cube is given. If $|EM| = 2|EL|$, then find value of $\sin(\angle EAL)$.

A) $\frac{\sqrt{22}}{11}$

B) $\frac{\sqrt{11}}{11}$

C) $\frac{\sqrt{2}}{11}$

D) $\frac{1}{11}$



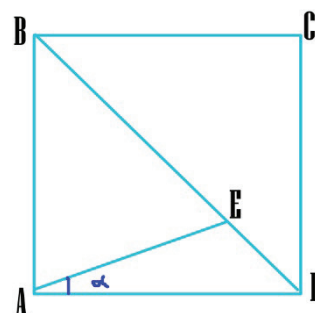
28. ABCD is a square. If $|BE| = 3|ED|$, find value of $\tan \alpha$.

A) $\frac{1}{2}$

B) 3

C) $\frac{1}{3}$

D) $\frac{1}{4}$



29. There are $(4x^2+20x+25)^6$ apples in the basket A, and $(x+4)^{12}$ apples in a basket B. If there are the same numbers of the apples in both of the baskets, find the product of the values of x .

A) 6

B) 5

C) 4

D) 3



30. In an ABC triangle with $AB = 3\text{cm}$, $BC = 6\text{cm}$, and $AC = 7\text{cm}$, what is the value of $\cos A$?

A) $\frac{1}{2}$ B) $\frac{11}{21}$ C) $\frac{20}{21}$ D) $\frac{\sqrt{2}}{2}$

31. In a triangle ABC , $AD \perp BC$, $|AD| = \log_b 125$, $|BD| = \log_{\sqrt[3]{5}} b$ and $|DC| = \log_5 b$ are given. Find the area of triangle ABC .

A) 6

B) 8

C) 10

D) $12\sqrt[3]{5}$

32. In the table below number of the people who gave blood and urine tests is shown. If $(x+10)$ people gave both tests and the total number of tests given is 224, find the number of people who gave a blood test.

A) 45

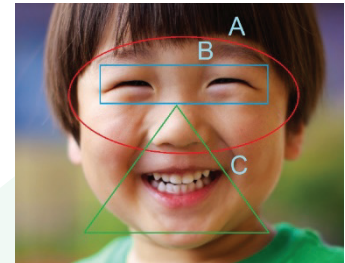
B) 76

C) 57

D) 13

Number of Tests	
Urine	$15x+18$
Blood	$7x+6$

33. In the picture above the parts of the face are given as sets A, B and C, where the universal set $E = \{Eyebrows, eyes, nose, mouth\}$. Therefore, which of the given condition(s) is (are) true for sets A, B and C?



- I. $A/(B \cup C) = \{Eyebrows\}$
- II. $C/(A \cup B) = \{nose, mouth\}$
- III. $(A \cap B) \cup C = \{eyes, nose, mouth\}$

A) I B) I, II C) I, III D) III

34. For the sets $A = \{n^6: 1 \leq n \leq 99, n \in \mathbb{Z}\}$, $B = \{x: 2^{24} \leq x \leq 3^{18}, x \in \mathbb{Z}\}$ is given.

Find the $n(A \cap B)$.

A) 12 B) 13 C) 20 D) 23

35. Sets A and B are given as: $A = \{(x; x^2): x \in R\}$, $B = \{(x; x+6): x \in R\}$.

If $A \cap B = \{(a, b), (c, d)\}$ then find the sum of $(a + b + c + d)$.

A) 10

B) 12

C) 13

D) 14

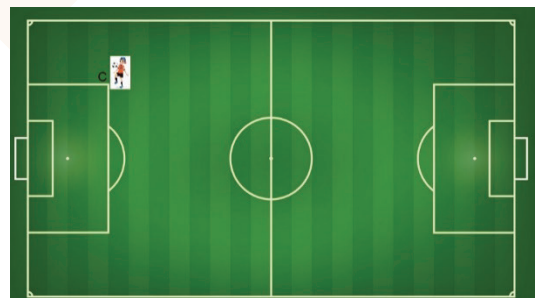
36. The coordinates of the player at the point C in the football field are given as $C(\log_3(19 - a), 2)$. He is closer to y-axis than x-axis. Find the sum of all integer values of a .

A) 112

B) 114

C) 116

D) 118



37. Function $f(n) = \frac{2n+3}{3n-2}$ is given. If a sequence $a_n = \underbrace{(f \circ f \circ f \dots \circ f)}_{n \text{ terms}}(n)$ is defined by

means of $f(n)$. Evaluate 2021st term of given sequence.

A) 2021

B) 1

C) $\frac{4045}{6061}$

D) $\frac{6061}{4045}$

38. In a box containing 100 balls labelled 1, 2, 3, . . . , 100. What is the probability of getting a ball that is a multiple of 5, but not multiple of 3, if a ball is taken at random?

A) $\frac{3}{25}$

B) $\frac{4}{25}$

C) $\frac{7}{50}$

D) 0

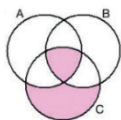
39. How many ways are there to form 4-digit numbers, where the product of their digits is 60? (Repetition of digits are allowed.)

- A) 72 B) 50 C) 48 D) 60

40. Given that $f(x) = ax^2 + bx + c$ passing through the point $(0, 3)$ and has a minimum point at $(-2, 1)$, what is the value of $a - b + c$?

- A) 4.5 B) 2.5 C) 1.5 D) $\frac{2}{9}$

Answers:



1. C) 12 2. D) 3. B) 7 4. D) 10 5. D) $3\sqrt{2} \text{ cm}$ 6. A) 12 7. B) 800
8. C) 80 kg 9. B) $\frac{21}{40}$ 10. A) $\frac{-12}{25}$ 11. A) 2 12. D) 8 13. C) 14. B) 5 15. D) 32
16. A) 24 17. C) 2 18. B) 9000 19. C) 3.16 20. D) 11 21. D) 2 22. C) 5 23. A) $\frac{13}{6}$
24. C) $5\sqrt{3} - 5$ 25. D) $\frac{\sqrt{3}}{4}$ 26. A) 3050 m 27. A) $\frac{\sqrt{22}}{11}$ 28. C) $\frac{1}{3}$ 29. D) 3 30. B) $\frac{11}{21}$
31. A) 6 32. B) 76 33. C) I, III 34. A) 12 35. D) 14 36. C) 116 37. C) $\frac{4045}{6061}$
38. C) $\frac{7}{50}$ 39. D) 60 40. C) 1.5



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