International Online Math Challenge

Online International Math Challenge

Past Papers 2021

Category 2

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 2 Topics

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

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

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1. If A=2+3-2×3, B=1^2+3^2-(2-3), C= (2-3)^2+4:2^2, calculate A+B×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 ◊ is defined as an $\alpha \diamond \beta = 3\alpha + \beta - 1$, 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+...+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 %, 4/27, 0.15, 5/28.

A) 13 %, 4/27, 0.15, 5/28   B) 13 %, 4/27, 5/28, 0.15

C) 4/27, 13%, 5/28, 0.15   D) 4/27, 13 %, 0.15, 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?
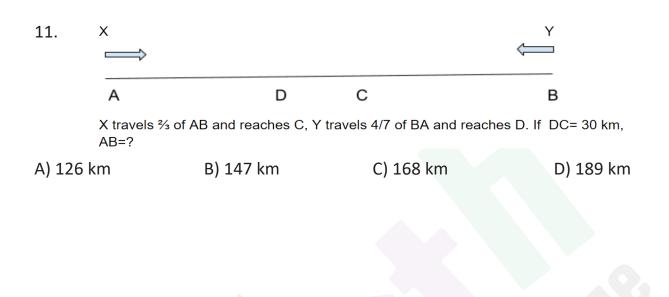
A) 46   B) 1696   C) 1706   D) 1726

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 ⅔ of AB and reaches C, Y travels 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) $\dfrac{69}{130}$ B) $\dfrac{67}{130}$

C) $\dfrac{65}{130}$ D) $\dfrac{63}{130}$

10 LT
50 %
ALCOHOL

A

8 LT
60 %
ALCOHOL

B

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

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

$[(18 \circledast x) \circledcirc (y @ 4)] + z.$

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?
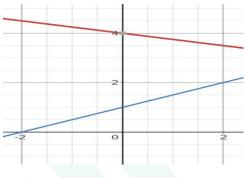
A) 850 $ B) 885 $ C) 890 $ D) 895 $

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

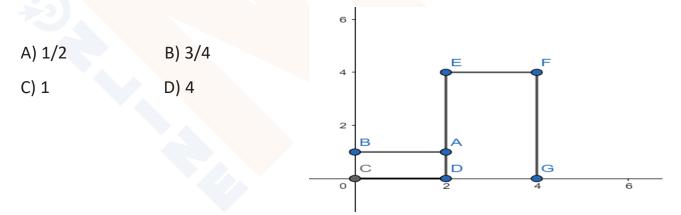A) 1/5   B) 4/9   C) 4/6   D) 25

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) 1/2   B) 3/4

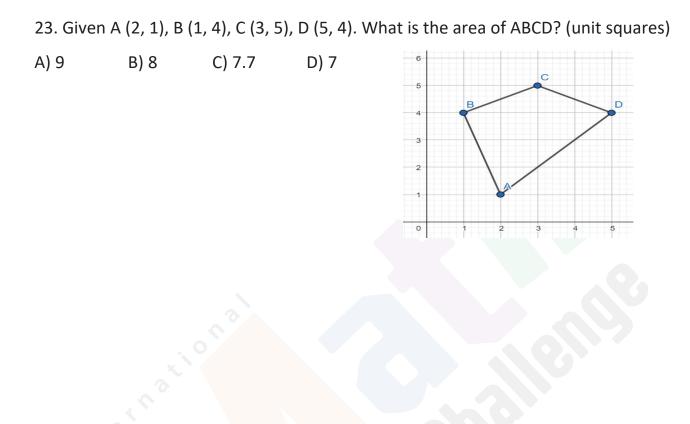C) 1   D) 4

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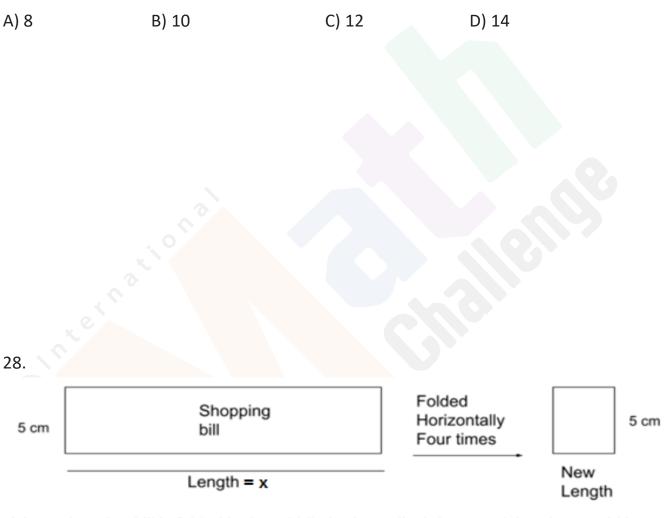
A) a=10, b=4, c=3, d=9

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.

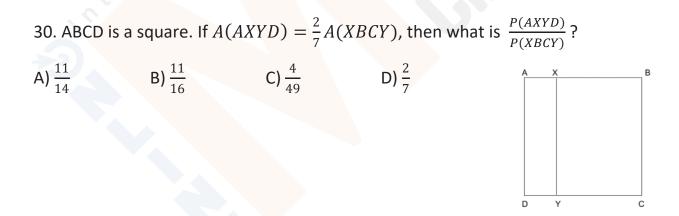A) 390　　　　　　　B) 395　　　　　　　C) 400　　　　　　　D) 420
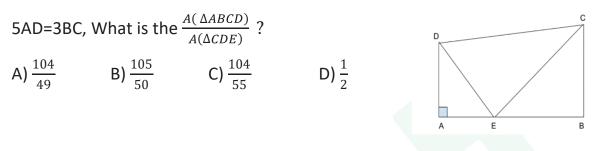
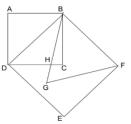29. Find angle a, when it is 5: 50 am.

A) 124^0 B) 125^0

C) 21^0 D) 30^0

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 // BC. $8 \times A(\Delta AED) = 3 \times A(\Delta BCE)$, and 5AD=3BC, What is the $\frac{A(\Delta ABCD)}{A(\Delta CDE)}$?

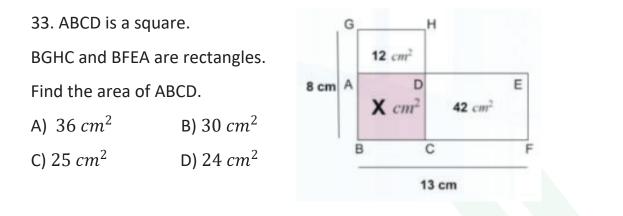A) $\frac{104}{49}$　　　　B) $\frac{105}{50}$　　　　C) $\frac{104}{55}$　　　　D) $\frac{1}{2}$

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?

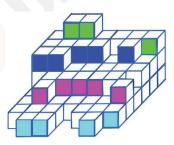A) $\frac{1}{2}$ B) $\frac{3}{7}$ C) $\frac{4}{7}$ D) $\frac{3}{4}$

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

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

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

A) -100   B) -50   C) 50   D) 100
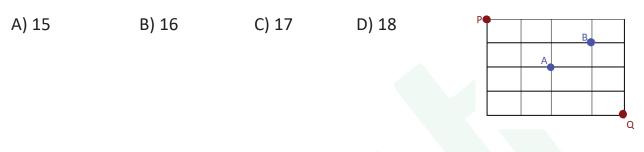
38. Find the number of the cubes in the picture.

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) $\dfrac{-4}{x^2-x-6}$ **3.** B) 4   **4.** D) 1   **5.** D) 32   **6.** A) 135   **7.** C) 5

8. A) 13 %, 4/27, 0.15, 5/28   **9.** D) 1726   **10.** A) 330 days older   **11.** A) 126 km

12. A) $\dfrac{69}{130}$ **13.** B) 50.5   **14.** D) $\dfrac{5}{24}s$ **15.** C) 3h:16 min:4/11s   **16.** A) 40   **17.** B) 885$

18. D) 25   **19.** D) 7   **20.** B) $\dfrac{3}{4}$ **21.** C) $\dfrac{11}{7}$ **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) $\dfrac{11}{16}$

31. A) $\dfrac{104}{49}$ **32.** C) 105   **33.** A) $36\ cm^2$ **34.** D) $\dfrac{4}{11}$ **35.** A) $\dfrac{1}{2}$ **36.** B) 25   **37.** C) 50

38. C) 88   **39.** D) 18   **40.** C) Range

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Only challengers can make a change!