



# UNIFIED COUNCIL

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Unified International  
Mathematics Olympiad

## UNIFIED INTERNATIONAL MATHEMATICS OLYMPIAD (UPDATED)

CLASS - 8

Question Paper Code : UM9246

### KEY

1	2	3	4	5	6	7	8	9	10
B	D	B	D	C	D	A	C	C	C
11	12	13	14	15	16	17	18	19	20
C	A	C	B	D	A	C	D	C	D
21	22	23	24	25	26	27	28	29	30
A	A	B	C	A	B	D	C	B	B
31	32	33	34	35	36	37	38	39	40
A,C,D	A,D	A,B,C	B,D	A,B,D	B	D	C	A	A
41	42	43	44	45	46	47	48	49	50
B	C	A	D	B	B	C	B	B	C

### EXPLANATIONS

#### MATHEMATICS - 1

1: (B) Given  $\frac{CP(100+16)}{100} = ₹2117$

$$\therefore CP = ₹2117 \times \frac{100}{116}$$

$$= ₹1825$$

2: (D) Given  $\sqrt{0.04 \times 0.4 \times a} = 0.004 \times 0.4 \times \sqrt{b}$

Squaring on both sides

$$0.04 \times 0.4 \times a = (0.004)^2 \times (0.4)^2 \times b$$

$$\frac{0.04 \times 0.4}{(0.004)^2 \times (0.4)^2} = \frac{b}{a}$$

$$\frac{1}{0.4} \times \frac{0.04}{0.000016} = \frac{b}{a}$$

$$\frac{b}{a} = \frac{400000}{64} = 6250$$

3: (B) Option 'B' is the top view of the given solid

4: (D) Given Profit = 20% of SP =  $\frac{20}{100} \times SP = \frac{SP}{5}$

$$CP = SP - \text{Profit} = SP - \frac{SP}{5} = \frac{4SP}{5}$$

Profit percentage on CP

$$= \frac{\text{Profit}}{CP} \times 100 = \frac{\left(\frac{SP}{5}\right)}{\left(\frac{4SP}{5}\right)} \times 100$$

$$= 25\%$$

5: (C)  $512 = 8^3$ ,  $343 = 7^3$ ,  $1331 = 11^3$

6: (D) Dividend = Divisor  $\times$  Quotient + Remainder

$$3a^2 + 5a + 7 = \text{Divisor} \times (3a - 1) + 9$$

$$3a^2 + 5a + 7 - 9 = \text{Divisor} \times (3a - 1)$$

$$\text{Divisor} = \frac{3a^2 + 5a - 2}{(3a - 1)}$$

$3a - 1$	$3a^2 + 5a - 2$	$a + 2$
	$3a^2 - a$	
	$(-)$	$(+)$
	$6a - 2$	
	$6a - 2$	
	$(0)$	

$$\therefore \text{Divisor} = (a + 2)$$

7: (A) Depth =  $\frac{\text{Volume}}{\text{length} \times \text{breadth}} = \frac{2.8\text{m}^3}{10\text{m} \times 2\text{m}}$

$$= \frac{2.8\text{m}^3}{20\text{m}^2}$$

$$= \frac{2.8\text{m}}{20} = \frac{280\text{cm}}{20}$$

$$= 14\text{ cm}$$

8: (C) Given  $3^x = \frac{\sqrt{3}}{27}$

$$3^x = \frac{3^{\frac{1}{2}}}{(3^3)}$$

$$3^x = 3^{\frac{1}{2}-3}$$

$$\therefore x = \frac{1}{2} - 3 = \frac{1-6}{2} = -\frac{5}{2}$$

9: (C) For 8 years the amount becomes 4 times principal

For 12 years the amount becomes 8 times principal

10: (C) CP of first house

$$= \frac{SP \times 100}{(100 + g)} = \frac{\text{₹ } 336260 \times 100}{(100 + 15)}$$

$$= \frac{\text{₹ } 336260 \overset{67252}{\times 100}}{115 \underset{231}{}}$$

CP of first house = ₹ 292400

CP of second house

$$= \frac{\text{₹ } 336260 \times 100}{(100 - 15)} = \frac{\text{₹ } 336260 \overset{67252}{\times 100}}{85 \underset{21}{}}$$

$$= \text{₹ } 395600$$

Total CP = ₹ 292400 + ₹ 395600

$$= \text{₹ } 688000$$

Total SP = 2  $\times$  ₹ 336260 = ₹ 672520

Total loss = ₹ 688000 - ₹ 672520

$$= \text{₹ } 15480$$

Total loss percentage

$$= \frac{\text{₹ } 15480}{\text{₹ } 688000} \times 100$$

$$= 2.25\%$$

11: (C)  $x^2 + ax - bx - ab = x(x + a) - b(x + a)$

$$= (x + a)(x - b)$$

12: (A) Angle of the sector

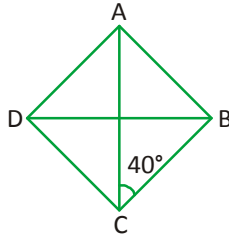
$$= \frac{\text{No. of students who got grade 'C'}}{\text{Total students}} \times 360^\circ$$

$$= \frac{8}{27} \times 360^\circ$$

$$= 144^\circ$$

13: (C) Given  $\angle ACB = 40^\circ \Rightarrow \angle ACD = 40^\circ$

$$\therefore \angle BCD = 40^\circ + 40^\circ = 80^\circ$$



But  $\angle ABC + \angle BCD = 180^\circ$  [ $\because AB \parallel CD$ ]

$$\angle ABC + 80^\circ = 180^\circ$$

$$\angle ABC = 180^\circ - 80^\circ = 100^\circ$$

$$\therefore \angle ABD = \frac{\angle ABC}{2} = \frac{100^\circ}{2} = 50^\circ$$

14: (B) Part of the work done by 'A' in 8 days

$$= \frac{8}{20} = \frac{2}{5}$$

15: (D) Given  $\sqrt{3}a = 9\sqrt{3}$  cm

$$\therefore a = \frac{9\sqrt{3}}{\sqrt{3}} \text{ cm} = 9 \text{ cm}$$

$$\text{Surface area} = 6a^2 = 6 \times (9 \text{ cm})^2 = 6 \times 81 \text{ cm}^2 = 486 \text{ cm}^2$$

$$16: (A) \frac{1}{1+a^b} + \frac{1}{1+a^{-b}} = \frac{1}{1+a} + \frac{1}{1+\frac{1}{a^b}} = \frac{1}{1+a^b} + \frac{1}{\left(\frac{a^b+1}{a^b}\right)}$$

$$= \frac{1}{(1+a^b)} + \frac{a^b}{(1+a^b)}$$

$$= \frac{(1+a^b)}{(1+a^b)}$$

$$= 1$$

17: (C) Profit = ₹ 41.8 – ₹ 38 = ₹ 3.8

Profit percentage

$$= \frac{\text{Profit}}{\text{CP}} \times 100 = \frac{₹ 3.8}{₹ 38} \times 100 = 10\%$$

18: (D) Given  $DEF \times D = 10DF$  then  $345 \times 3 = 1035$

$$\therefore D = 3, E = 4 \text{ \& } F = 5$$

$$\therefore D + E + F = 3 + 4 + 5 = 12$$

19: (C) It is in indirect variation

$$\therefore x_1 y_1 = x_2 y_2$$

$$\therefore (150) \times (45 - 10) = (150 - 25) y_2$$

$$\frac{150^6 \times 35^7}{125^{y_1}} = y_2$$

$$y_2 = 42$$

20: (D) Given  $\frac{x+c}{x+1} = c+1$

$$x + c = (x + 1)(c + 1)$$

$$x + c = (xc + x + c + 1)$$

$$xc + 1 = 0$$

$$xc = -1$$

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

21: (A)

3	9999	316
	9	
61	99 61	
626	3899 3756	
	143	

$\therefore$  The greatest 5 digit perfect square = 99999 – 143

$$= 99856$$

22: (A) Let MP be ₹  $x$

$$\therefore SP_1 = \frac{mp(100-d)}{100} = \frac{₹x(100-20)}{100} = \frac{₹4x}{5}$$

$$\therefore SP_2 = \frac{₹4x(100-10)}{5 \times 100} = \frac{₹36x}{50}$$

$$SP_3 = \frac{₹36x(100-5)}{50 \times 100} = \frac{₹36x \times 19}{50 \times 20} = \frac{₹684x}{1000} = \frac{₹68.4x}{100}$$

Single discount

$$= ₹x - \frac{₹68.4x}{100} = \frac{₹100x - ₹68.4x}{100}$$

$$= \frac{₹31.6x}{100}$$

23: (B)  $P = \left(-\frac{2}{5}\right)^2 = \frac{4}{25} = 0.16$ ,  $Q = (0.3)^2 = 0.09$

$$R = \left(-\frac{3}{4}\right)^3 = -\frac{27}{64} = -0.42$$
,  $S = (-1.2)^2 = 1.44$

$$\therefore 1.44 > 0.16 > 0.09 > -0.42$$

i.e.  $S > P > Q > R$

24: (C) Given  $a^2 = 7396$  sq metres

$$a^2 = (86 \text{ m})^2$$

8	$\overline{73 \ 96}$ 64	86
166	$\overline{996}$ 996	
	(0)	

$\therefore$  side of square (a) = 86 m

$\therefore$  Perimeter =  $4a = 4 \times 86 \text{ m} = 344 \text{ m}$

25: (A)  $3 \text{ h } 20 \text{ min} : 5 \text{ h} = 20 \text{ km} : x \text{ km}$

$$\frac{200 \text{ min}^2}{300 \text{ min}^3} = 20 : x$$

$$\therefore 2x = 60$$

$$x = \frac{60}{2} = 30$$

26: (B) Discount = MP - SP = ₹ 20 - ₹ 18 = ₹ 2

$$\therefore \text{Discount Percentage} = \frac{\text{Discount}}{\text{MP}} \times 100$$

$$= \frac{₹2}{₹20} \times 100 = 10\%$$

27: (D) Let the principal be ₹  $x$  & rate of interest be  $y\%$

$$\text{Given } ₹x \left(1 + \frac{4y}{100}\right) = ₹12271$$

$$₹x \left(1 + \frac{y}{25}\right) = ₹12271 \rightarrow (1)$$

Similarly

$$₹x \left(1 + \frac{6^3 y}{100 \times 50}\right) = ₹14024 \rightarrow (2)$$

$$\frac{\text{eq(2)}}{\text{eq(1)}} \Rightarrow \frac{\cancel{₹x} \left(\frac{50+3y}{50}\right)}{\cancel{₹x} \left(\frac{25+y}{25}\right)} = \frac{₹14024}{₹12271}$$

$$\frac{(50+3y)}{\cancel{50}_2} \times \frac{\cancel{25}^1}{(25+y)} = \frac{14024}{12271}$$

$$\frac{50+3y}{50+2y} = \frac{14024}{12271}$$

$$(50+3y)(12271) = (50+2y)(14024)$$

$$613550 + 36813y = 701200 + 28048y$$

$$36813y - 28048y = 701200 - 613550$$

$$8765y = 87650$$

$$y = \frac{87650}{8765} = 10\%$$

28: (C) Given  $a + b + c = 6$

Squaring on both sides

$$(a + b + c)^2 = 6^2$$

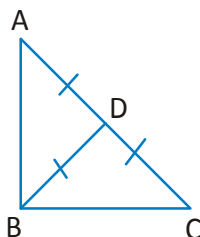
$$a^2 + b^2 + c^2 + 2(ab + bc + ca) = 36$$

$$26 + 2(ab + bc + ca) = 36$$

$$2(ab + bc + ca) = 36 - 26 = 10$$

$$ab + bc + ca = \frac{10}{2} = 5$$

- 29: (B) In  $\triangle ABD$ , given  $AD = DB \Rightarrow \angle ABD = \angle A = x$   
 In  $\triangle BCD$  given  $BD = DC \Rightarrow \angle C = \angle DBC = y$   
 In  $\triangle ABC$ ,  $\angle A + \angle ABD + \angle DBC + \angle C = 180^\circ$



$$x + x + y + y = 180^\circ$$

$$2x + 2y = 180^\circ$$

$$2(x + y) = 180^\circ$$

$$x + y = \frac{180^\circ}{2} = 90^\circ$$

$$\therefore x + y = \angle ABD + \angle DBC = 90^\circ$$

$$\Rightarrow \angle ABC = 90^\circ$$

- 30: (B) Given  $a^x = b$

$$\Rightarrow (a^x)^y = b^y$$

[ $\therefore$  Rising power 'y' on both sides]

$$a^{xy} = a \quad [\therefore \text{Given } b^y = a]$$

$$\therefore xy = 1$$

- 31: (A, C, D)

Option 'A'  $2 - 32x^2 = 2(1 - 16x^2) = 2[1^2 - (4x)^2]$

$$2 - 32x^2 = 2(1 - 4x)(1 + 4x)$$

Option 'B'  $4x^2 - 49 = (2x)^2 - 7^2 = (2x + 7)(2x - 7)$

Option 'C'  $-18x^2 + 27x = -9x(2x - 3)$

Option 'D'  $-25 - 150p^2 = -25(1 + 6p^2)$

- 32: (A, D)

$x - \frac{5}{7}$	$x^2 + \frac{24x}{35} - 1$	$x + \frac{7}{5}$
	$x^2 - \frac{5x}{7}$	
	(-) (+)	
	$\frac{74x}{35} - 1$	
	$\frac{7x}{5} - 1$	
	(0)	

$$\therefore \left(x^2 + \frac{24x}{35} - 1\right) = \left(x - \frac{5}{7}\right)\left(x + \frac{7}{5}\right)$$

- 33: (A, B, C)

In  $\triangle ABD$ , given  $AB = BD \Rightarrow \angle D = \angle DAB = x$

$$\therefore x + x = 60^\circ$$

$$\therefore 2x = 60^\circ$$

$$x = \frac{60^\circ}{2} = 30^\circ$$

In  $\triangle ACE$ , given  $AC = CE \Rightarrow \angle E = \angle CAE = y$

$$\therefore y + y = 80^\circ$$

$$\therefore y = 40^\circ$$

In  $\triangle ABC$ ,  $60^\circ + 80^\circ + \angle BAC = 180^\circ$

$$\angle BAC = 180^\circ - 140^\circ = 40^\circ$$

$$\therefore \angle EAB = y + \angle BAC = 40^\circ + 40^\circ = 80^\circ$$

$$\angle DAC = x + \angle BAC = 30^\circ + 40^\circ = 70^\circ$$

$$\angle DAE = x + \angle BAC + y = 30^\circ + 40^\circ + 40^\circ = 110^\circ$$

34: (B, D)

Options B & D are the nets of a cube

35: (A, B, D)

Option A :  $1^3 + 2^3 + 3^3 + 4^3 + 5^3 = 1 + 8 + 27 + 64 + 125 = 225 = 15^2$

Option B :  $1^3 + 2^3 + 3^3 + 4^3 + 5^3 + 6^3 = 225 + 216 = 441 = 21^2$

Option 'C'  $2^3 + 3^3 + 4^3 + 5^3 + 6^3 + 7^3 = 440 + 343 = 783$  not a perfect square

Option 'D'  $4^3 + 5^3 + 6^3 + 7^3 + 8^3 + 6^3 = 64 + 125 + 216 + 343 + 512 + 36 = 1296 = 36^2$  is a perfect square

**REASONING**

36: (B) The series follows two rules.

**rule 1:** The letters at odd places are letters in English alphabets written from B, C, D, E and so on.

**rule 2:** The two letters at even places are the letters which are after and before the term at rule 1 (above) in the English alphabet.

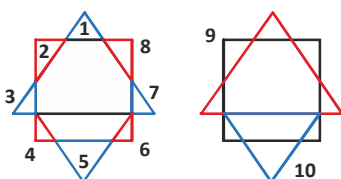
37: (D) Either mirror CD or AB is not represent the image 2 from image 1.

38: (C) Since a day of the week repeat after every 7 days, divide 59 by 7, remainder is 3 so number of odd days is 3, and 3 days after Monday is Thursday.

39: (A) All tigers are animals, and all herbivores are animals

40: (A) The first two have a relationship of Always and Seldom. Hence, the third and the 4<sup>th</sup> words should have the same relationship which is shown in option A. Seldom means rarely. Always means forever.

41: (B) The pentagon when cut along the 2 dotted line would give identical shapes as this line divide the pentagon in two identical parts.



42: (C)

43: (A) HORSE

44: (D)



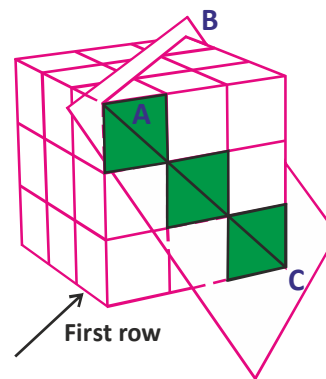
45: (B)

Ram left his house at 6:40 AM. He reached Kunal's house at 7:05 AM. They finished their breakfast in 15 minutes and left for office at 7:20 AM.

**CRITICAL THINKING**

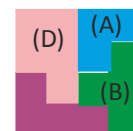
46: (B)

As highlighted in the below image, in the first row, three cubes get cut. This is because the cut plane passes through the edge/corner vertex of the cubes. For the other two rows, 3 cubes will get cut in each row.



47: (C)

In the below image, I've shown the parts that can form into a square.



Option (C) is not a part of the square.

48: (B)

Conditions i, iii, and iv ==> A and C are under 30, and B is over 30.

Conditions ii, v and vi ==> B and E are nurses, and A is a teacher.

3 Women under 30	2 Women over 30	3 Nurses	2 Teachers
A C ?	?	B E ?	A ?

So A is a teacher under 30.

Conditions ii and vii ==> the other teacher must be over 30.

Conditions vi ==> C or D is the other teacher over 30.

But C is under 30, so D is the other teacher over 30.

∴ F will Marry D.

49: (B) In figure, the dot lies in the region common to all the three figures -- squares, triangle and circle. Out of the four alternatives, only Fig. (B) contains a region common to all the three figures.

50: (C) B-1, E-2, C-3, A-4, D-5

=====*The End*=====