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ASSOCIATION OF MATHEMATICS TEACHERS OF INDIA (AMTI)

PRIMARY LEVEL-2020-21

Classes V & VI

Saturday, 24th April 2021

Instructions:

1. Answer as many questions as possible.
2. Elegant and novel solutions will get extra credits.
3. Diagrams and explanations should be given wherever necessary.
4. Fill in FACE SLIP and your rough working should be in the answer book.
5. Maximum time allowed is THREE hours.
6. All questions carry equal marks.

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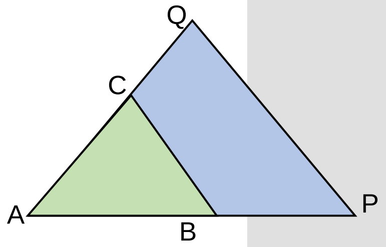
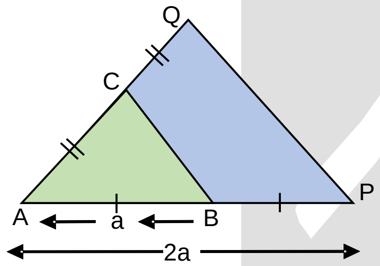
1. In Δ ABC, the side AB extended to P and AB is extended to P and AC is extended to Q such that AB = BP and AC = CQ, as shown. If the area of a quadrilateral is 21 cm^2, then find the area of ΔABC.



Sol.



Given Ar quad. BCQP = 21 cm^2

To find Ar ΔAQP

Let AB = a then AP = 2a

$\therefore \dfrac{Ar\Delta ABC}{Ar\Delta AQP} = \left(\dfrac{a}{2a}\right)^2$

$\dfrac{Ar\Delta ABC}{Ar\Delta AQP} = \dfrac{1}{4}$

4 Ar ΔABC = Ar ΔAQP

4 Ar ΔABC = Ar ΔABC + Ar quad BCQP

3Ar ΔABC = 21

Ar ΔABC = 7 cm^2

2. Arrange the following fraction is ascending order : $\dfrac{10}{31}, \dfrac{25}{61}, \dfrac{17}{71}, \dfrac{37}{73}$. Justify with reasons.

Sol. Arrange in ascending order $\dfrac{10}{31}, \dfrac{25}{61}, \dfrac{17}{71}, \dfrac{37}{73}$

Make either numerator of diominator some

$\therefore$ Making numerator some

L.C.M. (10, 25, 17, 37) = 31450

$\frac{10}{31} \times \frac{3145}{3145} = \frac{31450}{97495}$ $\frac{17}{71} \times \frac{1850}{1850} = \frac{31450}{131350}$

$\frac{25}{61} \times \frac{1258}{1258} = \frac{31450}{76738}$ $\frac{37}{73} \times \frac{850}{850} = \frac{31450}{62050}$

Greater the denominator smaller will be the number

$\therefore \frac{17}{71} < \frac{10}{31} < \frac{25}{61} < \frac{37}{73}$

3. Let M be the sum of all possible 4 digit numbers with different digits formed from digits 1, 2, 3, 4 Let N be the sum of all possible 4 digit numbers with different with different digits formed from digits 2, 4, 6, 8.

Find the value of $\frac{N}{M}$.

Sol. M = Sum of all the four digit number with different digits 1, 2, 3, 4

No. of 4 digit numbers | 4 | 3 | 2 | 1 | = 4 × 3 × 2 × 1 = 24

Sum of these four digit no.:

Four digit number can be written in the form of

1000a + 100 b + 10c + d

Now a, b, c, d, can be 1, 2, 3, 4

24 × [1000 (1+2+3+4) + 1000 (1+2+3+4) + 10(1+2+3+4) + (1+2+3+4)]

24 × [1000 + 100 + 10 + 1] = 240 × 1111 = 266640

$\therefore$ M = 266640

N = sum of 4 digit number with different digit 2, 4, 6, 8

Now similarly

24[1000(2+4+6+8) + 100 (2 + 4 + 6 +8) + 10 (2+4+6+8) + (2+4+6+8)]

24(1000 × 20 + 100 × 20 + 10 × 20 + 20)

24 × 20 (1000 + 100 + 10 + 1)

480 × 1111 = 533280

$\therefore$ N = 533280

$\frac{N}{M} = \frac{533280}{266640} = \frac{2}{1}$

So, $\therefore$

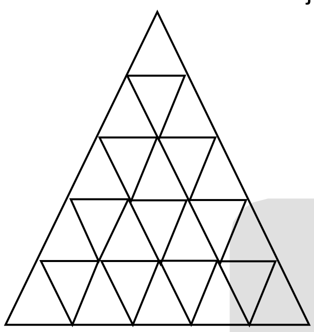
4. Find two, 100-digit numbers with non-zero digits and sum of the digits 125, that is divisible by the sum of its digits. Explain the process by which you arrived the numbers

Sol. 100 digit number, divisible by sum its digit i.e. 125 and have non-zero digit

Acc to table of 125
125 × 1 = 125
125 × 2 = 250
125 × 3 = 375
125 × 4 = 500
125 × 5 = 625
125 × 6 = 750
125 × 7 = 875

125 × 8 = 900
125 × 9 = 1125
125 × 10 = 1250
we can see that, to be divisible by 125 number's
Unit digit = 5
Ten's digit = 2/7
∴ I number
11111 (…….95 times) 98625
II number
11111 (…..95 times) 89625

5. The diagram shows a grid of twenty five identical equilateral triangles. How many different rhombuses can be formed from two adjacent small triangles ?



Sol. Number of Rhombus = 30

6. A sequence has all 4-digit numbers from 1000 till 2021 that contains 3 even digits and 1 odd digit. The sequence has numbers in ascending order with no number repeating. The sequence is : 1000, 1002, 1004, 1006, ….. , 2018, 2021. How many numbers are there in the sequence ?

Sol. 4-digit number from 1000 to 2021
4-digit number with 3 even and 1000 digit
To find : Total number in sequence
Total numbers between 1000 to 1999

1	5	5	5

↓ ↓ ↓ ↓

1 2,4,6,8,0

= 5 × 5 × 5 = 125
Total number of numbers between 2000 — 2021

2001	2010	2021
2003	2012	
2005	2014	
2007	2016	
2009	2018	

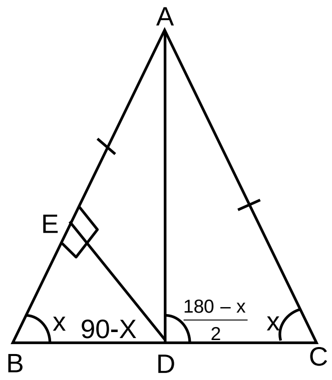
11 numbers

∴ Total numbers in the sequence
125 + 11 = 136

7. It is observed that Wednesday appears across dates 3, 5, 6 only in a particular calendar year. Also, Wednesday appear exactly two time across each date 1, 2, 7 in that year. If the year is not a leap year, what is the day on January 1st of that year ?

Sol. In o non-leap year
(1) Calender of Feb, March and No is same
(2) Jan = Oct
April = July
Sept. = Dec
Above 3 pairs of months will be same
(3) May, June, Aug are different
∴ 7 Jan = 7 Oct. = Wed
1 April = 1 July = Wed
2 Sept. = 2 Dec = Wed
6 May / 3 June / 9 Aug = Wednesday
4 Feb/ 4 May/ 4Nov = Wednesday
So, ∴ 1 Jan = Thursday

8. DABC is an isosceles triangle with AB = AC. D is a point on BC such that AB = CD. Draw DE $\perp$ AB at E. Show that 2 $\angle$ADE = 3$\angle$B.



Sol.

To show : 2 $\angle$ADE = 3$\angle$B

Given : AB = AC, AB = CD

In ΔABC

$\because$ AB = AC

$\therefore$ $\angle$B = $\angle$C = x (Angle opposite to equal sides ar equal)

In ΔEBD

x + 90 + $\angle$EBD = 180

$\therefore$ $\angle$EDB = 90 –x

In ΔADC

AC = CD

$\therefore$ $\angle$ADC = $\angle$DAC (Angle opposite to equal)

$\angle$ADC + $\angle$DAC + $\angle$ACD = 180°

$2\angle ADC = \frac{180-x}{2} = 90 - \frac{x}{2}$

$\angle$EDB + $\angle$EDA + $\angle$ADC = 180 (Lying on st. line)

$90 - x + \angle EDA + 90 - \frac{x}{2} = 180°$

$\angle EDA = \frac{3x}{2} \Rightarrow \therefore \angle EDA = 3x$

2 $\angle$EDA = 3$\angle$E Hence proved