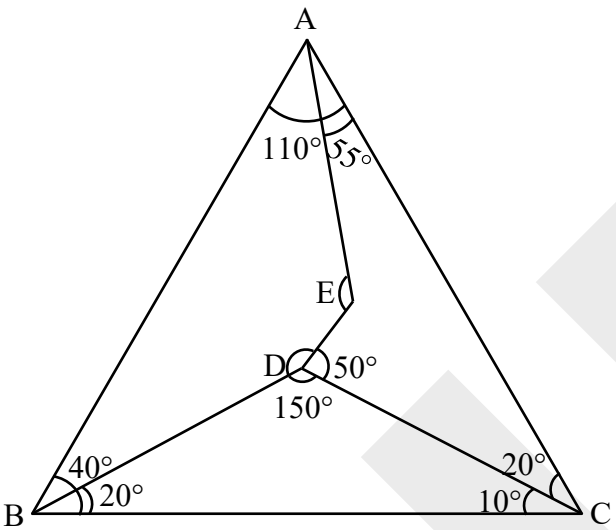
SOLUTION

THE ASSOCIATION OF MATHEMATICS TEACHERS OF INDIA

AMTI – NMTC – 25th October, 2025 – PRIMARY FINAL

1. ABC is a triangle in which ∠CAB : ∠ABC : ∠BCA = 11 : 4 : 3. The line through point C making an angle $\frac{\angle BCA}{3}$ with BC meets the line through point B which bisects ∠ABC, at D. The bisector of ∠CAB and the line through D making an angle $\frac{\angle BDC}{3}$ with CD, meet at E. Find and write the measure of ∠AED.

Sol.



ATQ : ∠CAB = 110°

∠ ABC = 40°

∠BCA = 30°

ATQ $\frac{\angle BCA}{3} = 10° = \angle BCD$

$\frac{\angle ABC}{2} = 20°$

So, ∠BDC = 150°

So, In □AEDC

55° + 20° + Reflex ∠AED + 50° = 360°

Reflex ∠AED = 235°

So required ∠AED = 125°

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2. Consider the seven-digit number $5a793a4$, where a is a digit. Find all such seven-digit numbers which are divisible by 3. Write down the smallest and the largest of these numbers and write the difference between these two numbers.

Sol. Divisible by 3

$5 + a + 7 + 9 + 3 + a + 4 = 28 + 2a$

So $a = 1, \quad a = 7$

$a = 4$

So possible number

5 1 7 9 3 1 4

5 4 7 9 3 4 4

5 7 7 9 3 7 4

Largest = 5779374

Smallest = 5179314

Difference = 600,060

3. N is a two-digit number. The digit 3 is affixed to the right of N to make it a three-digit number. The new number is 777 more than the original number. Find N.

M is a two-digit number. M is equal to 4 times the sum of its digits. Find all such two digit numbers. Let P be the average of such all two-digit numbers. Calculate N + P.

Sol. $10N + 3 = N + 777$, Here $N = 10a + b$.

$10N - N = 777 - 3 = 774$

$N = 86$

$M = 10x + y$

$M = 4(x + y)$

$6x = 3y$

$2x = y$

$x \ \& \ y \neq 0$

$x = 1, y = 2, M = 12$

$x = 2, y = 4, M = 24$

$x = 3, y = 6, M = 36$

$x = 4, y = 8, M = 48$

$$P = \frac{12+24+36+48}{4} = \frac{120}{4} = 30$$

Then, $N + P = 86 + 30 = 116$

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4. Look at the sequence 1, 1, 2, 3, 5, 8, 13 …. . This is called the Fibonacci sequence. Starting from the third term, each term is the sum of its immediate previous two terms.

For Ex : 5 = 2 + 3 8 = 3 + 5, 13 = 5 + 8 etc.

Find the remainder when the number in the 2025th term is divided by 3.

Sol. According to question :

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89

When we divide 3 by each number then we will get remainder as well :

$\underbrace{1,1,2,0,2,2,1,0}\ \underbrace{1,1,2,0,2,2,1,0}$ ……

This cyclicity generate every 8th terms.

So 2024th is divible by 8 so, 2025th term remainder is 1.

5. In an igloo pack there are two flavours of cup ice-cream, vanilla and butterscotch. First, Pramod removes 36 vanilla ice cups and 4 butterscotch cups. The remaining cups of ice-cream are divided into 11 groups. In each group, there are 8 vanilla and 3 butterscotch ice-cream cups. What is the greatest number of ice-cream cups in the pack if at least 80% of the total ice-cream cups are vanilla ice-cream cups?

Sol. Let vanilla $\rightarrow$ x & butterscotch $\rightarrow$ y

Remaining ice-cream $\rightarrow$ (x – 36) & (y – 4)

Divided into 11 groups

Each group have $\frac{x-36}{11}, \frac{y-4}{11}$ ice-creams

$\frac{x-36}{11}=8$ & $\frac{y-4}{11}=3$

x = 124 & y = 37

Total = 124 + 37 = 161

Condition :

$x > \frac{80}{100}(x+y)$

$x > \frac{80}{100}\times 161$

$x > \frac{1288}{10}$

x > 128.8

x = 129 approximate

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6. After the complete simplification of the fraction

$$\frac{\left(\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\frac{1}{6}\right)}{\left(\frac{1}{3}-\frac{1}{4}+\frac{1}{5}-\frac{1}{6}\right)}+\frac{\left(\frac{1}{3}+\frac{1}{4}-\frac{1}{5}-\frac{1}{6}\right)}{\left(\frac{1}{3}-\frac{1}{4}-\frac{1}{5}+\frac{1}{6}\right)}$$

The result is of the form $\frac{a}{b}$, where a and b are natural numbers with no common factor other than 1. What fraction to be subtracted from $\frac{a}{b}$ to get 1, what is the integer part of this fraction?

Sol. $\frac{\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\frac{1}{6}}{\frac{1}{3}-\frac{1}{4}+\frac{1}{5}-\frac{1}{6}}+\frac{\frac{1}{3}+\frac{1}{4}-\frac{1}{5}-\frac{1}{6}}{\frac{1}{3}-\frac{1}{4}-\frac{1}{5}+\frac{1}{6}}$

$=\frac{\frac{4+3}{12}+\frac{6+5}{30}}{\frac{4-3}{12}+\frac{6-5}{30}}+\frac{\frac{4+3}{12}-\frac{(6+3)}{30}}{\frac{4-3}{12}-\frac{(6-5)}{30}}$

$=\frac{\frac{7}{12}+\frac{11}{30}}{\frac{1}{12}+\frac{1}{30}}+\frac{\frac{7}{12}-\frac{11}{30}}{\frac{1}{12}-\frac{1}{30}}$

$=\frac{\frac{35+22}{60}}{\frac{5+2}{60}}+\frac{\frac{35-22}{60}}{\frac{5-2}{60}}$

$=\frac{57}{7}+\frac{13}{3}$

$=\frac{171+91}{21}=\frac{262}{21}=\frac{a}{b}$

A.T.Q. $\frac{262}{21}-\frac{x}{y}=1$

$\frac{x}{y}=\frac{262}{21}-1=\frac{262-21}{21}$

$\frac{x}{y}=\frac{241}{21}$

Fraction $=\frac{241}{21}=11.47$

Integer part = 11

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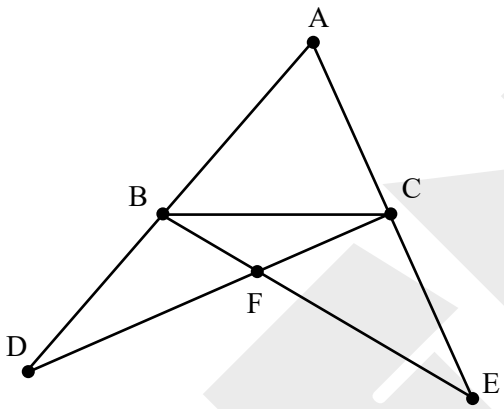
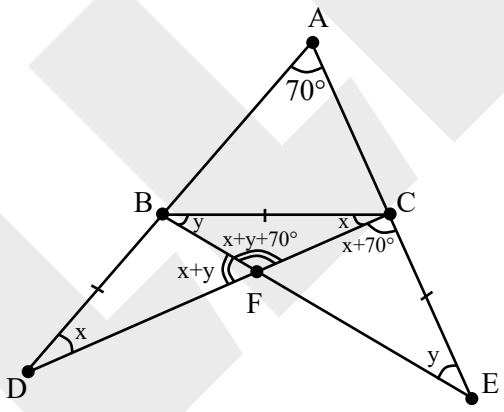
7. In triangle ABC, point D is taken on the extended side AB and point E is taken on the extended side AC such that BC = BD = CE. Line-segments BE and CD are drawn, which intersect each other in F. The measure of angle BAC = 70°, then find the measure of angle BFD. Justify your answer.



Sol. In diagram



$\angle BAC = 70°$

In ΔBCD

$BD = BC$

$\angle BDC = \angle BCD = x$ (let)

In ΔBCE

$BC = CE$

$\angle BEC = \angle EBC = y$ (let)

In ΔADC

$\angle ECF = x + 70°$ (exterior angle property)

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In ΔBCF

$\angle BFD = x + y$ (exterior angle) … (1)

In ΔCEF

$\angle BFC = (x + 70°) + y$ (exterior angle)

$\Rightarrow x + y + 70°$ … (2)

$\angle BFD + \angle BFC = 180°$ (linear pair)

$x + y + x + y + 70° = 180°$

$2x + 2y = 110°$

$x + y = 55°$ (from equation (1))

$\angle BFD = 55°$

8. Using the digits 0, 2, 4, 6, 8 each at least once form and write the greatest and the smallest seven-digit number divisible by 99. Justify your answer.

Also, find and write the difference between these numbers.

Sol. digits $\rightarrow$ 0, 2, 4, 6, 8 using digits at least once

We make the greatest and smallest 7 digit number divisible by 99 means number divisible by 9 and 11.

Sum of 7-digits number is divisible by 9 :

Sum of these 5 digits $(0 + 2 + 4 + 6 + 8) = 20$

Now, for sum of digit divisible by 9, possible sums are 27, 36 but here 27 is not possible as all the given digits are even no.

So, only condition we want to make sum of digits as 36.

For this we will repeat digit 8 more than 2 times which satisfy the sum:

If we take 8 digit two times make them sum of 7-digits = 36 (divisible by 9)

Therefore, 7 digits are $\rightarrow$ 0, 2, 4, 6, 8, 8, 8

For greatest 7 digits number

$\underbrace{8\ 8\ 8\ 6}_{\text{greatest digits}}\ \underbrace{a\ b\ c}_{0,2,4\text{ digits}}$ $\leftarrow$divisible by 11

$(8 + 8 + a + c) – (8 + 6 + b) = 0$ or multiple of 11

$(2 + a + c) – b = 0$ or multiple of 11

$(2 + a + c) – b = 0$

$b = 4, a + c = 2$

Greatest 7-digit number $\rightarrow$ 8 8 8 6 2 4 0

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For smallest 7-digit number :

$\underset{\text{Smallest digit other than 0}}{2}\ \underbrace{\underline{x}\ \underline{y}\ \underline{z}}_{\text{0,4,6 digits}}\ \underbrace{\underline{8}\ \underline{8}\ \underline{8}}_{\text{use greatest digits}}$ ← divisible by 11

$(2 + y + 8 + 8) - (x + z + 8) = 0$

$(18 + y) - (x + z + 8) = 0$

$(10 + y) - (x + z) = 0$

$y = 0,\ x + z = 10$

Smallest 7-digit number is $2\ \underset{x}{4}\ \underset{y}{0}\ \underset{z}{6}\ 8\ 8\ 8$

difference = 8886240 – 2406888

= 6479352