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# Secondary School Examination - 2020
# Marking Scheme- MATHEMATICS BASIC
## Subject Code : 241 Paper Code: 430 (B)

***General Instructions:***

1. You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.**Evaluation is a 10-12 days mission for all of us. Hence, it is necessary that you put in your best effortsin this process.**
2. Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and marks be awarded to them. In class-X, while evaluating two competency based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, marks should be awarded.**
3. The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
4. Evaluators will mark( √ ) wherever answer is correct. For wrong answer 'X"be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
5. If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly.
6. If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.
7. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.
8. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
9. A full scale of marks 0-80 has to be used. Please do not hesitate to award full marks if the answer deserves it.

10. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).
11. Ensure that you do not make the following common types of errors committed by the Examiner in the past:-
    - Leaving answer or part thereof unassessed in an answer book.
    - Giving more marks for an answer than assigned to it.
    - Wrong totaling of marks awarded on a reply.
    - Wrong transfer of marks from the inside pages of the answer book to the title page.
    - Wrong question wise totaling on the title page.
    - Wrong totaling of marks of the two columns on the title page.
    - Wrong grand total.
    - Marks in words and figures not tallying.
    - Wrong transfer of marks from the answer book to online award list.
    - Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.)
    - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
12. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0)Marks.
13. Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
14. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.
15. Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.
16. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

# QUESTION PAPER CODE 430(B)
# EXPECTED ANSWER/VALUE POINTS

## SECTION A

**1. The sum of the zeroes of the polynomial $3x^2 - 10x + 3$ is:**

**(A) 10** **(B) $\frac{10}{3}$** **(C) $-\frac{10}{3}$** **(D) 1**

**Sol.** (B) $\frac{10}{3}$ 1

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**2. The HCF of 135 and 225 is:**

**(A) 9** **(B) 15** **(C) 45** **(D) 25**

**Sol.** (C) 45 1

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**3. A card is drawn from a well shuffled deck of 52 cards. The probability that it is a card of black colour is:**

**(A) $\frac{1}{3}$** **(B) $\frac{1}{2}$** **(C) $\frac{1}{4}$** **(D) $\frac{3}{26}$**

**Sol.** (B) $\frac{1}{2}$ 1

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**4. The quadratic polynomial whose zeroes are – 3, 4 is:**

**(A) $x^2 + x - 12$** **(B) $x^2 - x - 12$** **(C) $x^2 - 7x + 12$** **(D) $x^2 + 7x - 12$**

**Sol.** (B) $x^2 - x - 12$ 1

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**5. The mid-point of line segment joining the points (–3, 2) and (7, 6) is:**

**(A) (– 2, – 4)** **(B) (–2, 4)** **(C) (4, 2)** **(D) (2, 4)**

**Sol.** (D) (2, 4) 1

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**6. The distance (in units) of the point (5, – 6) from the x-axis is:**

**(A) 6** **(B) 4** **(C) $\sqrt{61}$** **(D) – 6**

**Sol.** (A) 6 1

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**7. 840 can be expressed as a product of prime numbers as:**

**(A) $2^2 \times 6 \times 5 \times 7$** **(B) $2^3 \times 3 \times 5 \times 7$**

**(C) $2 \times 3 \times 4 \times 5 \times 7$** **(D) $3 \times 5 \times 7 \times 8$**

**Sol** (B) $2^3 \times 3 \times 5 \times 7$ 1

**8.** **From an exterior point T, tangents TP and TQ are drawn to a circle with centre O, which are inclined to each other at an angle of 55°. Then the ∠POQ equals:**

**(A) 35°** **(B) 125°** **(C)** $62\frac{1}{2}^\circ$ **(D) 60°**

**Sol.** (B) 125° 1

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**9.** **Which of the following is the decimal expansion of an irrational number?**

**(A) 3.14** **(B) 3.333...** **(C) 6.010010001...** **(D) 7.25**

**Sol.** (C) 6.010010001... 1

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**10.** **The graphical representation of cumulative frequency distribution is called:**

**(A) Bar chart** **(B) Pie chart** **(C) Histogram** **(D) Ogive**

**Sol.** (D) Ogive 1

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**Note:** **In questions 11 to 15, fill in the blanks, each question is of 1 mark:**

**11.** **If the radius of a solid right circular cylinder is 7 cm and its height is 10 cm, then its total surface area is _______ $cm^2$.**

**Sol.** 748 1

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**12.** **Given that in ΔABC, ∠B = 90°, tan A =** $\frac{1}{\sqrt{3}}$**, then the value of sin C is ________.**

**Sol.** $\frac{\sqrt{3}}{2}$

**OR**

**If tan θ =** $\frac{2}{3}$**, then the value of** $\cos^2\theta - \sin^2\theta$ **is _______.**

**Sol.** 5/13 1

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**13.** **If the corresponding sides of two similar triangles are in the ratio of 3 : 4, then the ratio of the areas of these triangles is _______.**

**Sol.** 9 : 16 1

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**14.** **If the point P divides the line segment joining the points (3, 2) and (6, 4) internally in the ratio of 2 : 1, then the coordinates of P are _______.**

**Sol.** (5, 10/3) 1

**15. The values of 'a' for which the pair of linear equations 3x + ay = 4 and 5x + 3y = 8 will have a unique solution, are _______.**

**Sol.** All real numbers except $\frac{9}{5}$

**OR**

**If the roots of the quadratic equation $2x^2 - 8x + k = 0$ are real and equal, then the value of k is _______.**

**Sol.** 8 1

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**Note: Answer the question no's. 16 to 20. Each questions is of 1 mark:**

**16. Two dice are thrown simultaneously. Find the probability that the sum of numbers appearing on the dice is six.**

**Sol.** Favourable cases (1, 5), (5, 1), (2, 4), (4, 2), (3, 3) = 5 $\frac{1}{2}$

Reqd. Probability, P(sum is six) = 5/36 $\frac{1}{2}$

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**17. Find the common difference of the A.P. whose third term is 8 and the seventh term is 20.**

**Sol.** $a + 2d = 8,\ a + 6d = 20$ $\frac{1}{2}$

$\Rightarrow\ d = 3$ $\frac{1}{2}$

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**18. In a Δ ABC, DE || BC. If AD = 1.75 cm, AB = 7 cm and AE = 2 cm, then find AC.**

**Sol.** $\frac{AD}{AB} = \frac{AE}{AC}$ or $\frac{1.75}{7} = \frac{2}{AC}$ $\frac{1}{2}$

$\therefore$ AC = 8 cm $\frac{1}{2}$

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**19. Find the value of cos 0°. cos 30° . cos 45° . cos 60°.**

**Sol.** $1 \times \frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{2}} \times \frac{1}{2}$ for any 2 correct values: $\frac{1}{2}$

$= \frac{\sqrt{3}}{4\sqrt{2}}$ or $\frac{\sqrt{6}}{8}$ $\frac{1}{2}$

**20. Find the value of sin 30° . cos 45° + sin 45° . cos 30°.**

**Sol.** $\frac{1}{2}\cdot\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{2}}\cdot\frac{\sqrt{3}}{2}$ for any 2 correct values: $\frac{1}{2}$

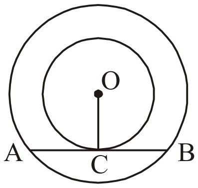
$= \frac{\sqrt{3}+1}{2\sqrt{2}}$ $\frac{1}{2}$

## SECTION B

**Question numbers 21 to 26 carry 2 marks each:**

**21. Prove that in two concentric circles, the chord of the larger circle, which touches the smaller circle is bisected at the point of contact.**

**Sol.** Let AB be chord of larger circle and touching smaller circle at C



Let O be centre

$\angle OCA = 90°$ (Angle between tangent and radius at point of contact) 1

in larger circle

$OC \perp AB$

$\therefore$ OC bisects AB ($\perp$ from centre to the chord bisects it) 1

**22. There are 16 cards bearing numbers 1, 2, 3 ....., 16 in a bag. A card is drawn at random from the bag. Find the probability of getting a card having a multiple of 3 on it.**

**Sol.** Favourable Number of cases (3, 6, 9, 12, 15) = 5 1

Total number of cases = 16

P (getting a card having a multiple of 3) = $\frac{5}{16}$ 1

**23. Show that sec 41° . sin 49° + cos 49° . cosec 41° = 2.**

**Sol.** LHS = cosec 49°. sin 49° + cos 49° . sec 49° 1

= 1 + 1 = 2 $\frac{1}{2}+\frac{1}{2}$

**OR**

**If cos(A – B) = sin(A + B) = 1, then find the values of A and B.**

**Sol.** A – B = 0°, A + B = 90° $\frac{1}{2}+\frac{1}{2}$

Solving we get A = 45°, B 45° $\frac{1}{2}+\frac{1}{2}$

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**24. A card is drawn at random from a pack of 52 cards. Find the probability that the drawn card is a red face card.**

**Sol.** Favourable number of cases: 6 1

Total number of cases: 52

P (Red face card) = $\frac{6}{52}$ or $\frac{3}{26}$ 1

**OR**

**All kings, queens and aces are removed from a pack of 52 playing cards and the remaining cards are well shuffled. A card is then drawn from the pack at random. What is the probability that (i) it is a face card, and (ii) a card of red colour?**

**Sol.** Number of remaining cards = 52 – 12 = 40 1

(i) P ((Face card) = $\frac{4}{40}$ or $\frac{1}{10}$ $\frac{1}{2}$

(ii) P(a card of red colour) = $\frac{20}{40}$ or $\frac{1}{2}$ $\frac{1}{2}$

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**25. Find the perimeter of a square circumscribing a circle of radius 3.5 cm.**

**Sol.** Diameter of circle = side of square

∴ Side of square = 7 cm 1

Perimeter of square = 4 × 7

= 28 cm 1

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**26. The students of a class wrote the following eight polynomials (one by each student) on the blackboard:**

**(i) $x^3 + 2x$** **(ii) $x^4 - x^2 + 3$**

**(iii) $x + 1$** **(iv) $8(x^3 - 1)$**

**(v) $\frac{2}{3}x+5$** **(vi) $x^4 + x^3$**

**(vii) $x^2 - 2x + 1$** **(viii) $x^4 - 1$**

**(a) How many of these are quadratic polynomials?**

**(b) Divide $(x^4 + x^3)$ by $(x + 1)$.**

**Sol.** (a) Only one {i.e. (vii) $x^2 - 2x + 1$} 1

(b) $\frac{x^4+x^3}{x+1} = \frac{x^3(x+1)}{x+1}$ or $x+1\overset{\displaystyle x^3}{\overline{\smash{)}x^4+x^3}}$ 1

$$\begin{array}{r} x^4+x^3 \\ \hline 0 \end{array}$$

$= x^3$

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## SECTION C

**Note: Question numbers 27 to 34 carry 3 marks each:**

**27. From a rectangular sheet of paper ABCD, in which AB = 40 cm, AD = 28 cm, a semi-circular portion with BC as diameter is cut off. Find the area of the remaining paper.**

**$\left(\text{Use } \pi = \frac{22}{7}\right)$**

**Sol.** Area of rectangle ABCD = 40 × 28 = 1120 $cm^2$ 1

Area of semi circular portion = $\frac{1}{2}\times\frac{22}{7}\times 14\times 14 = 308\,cm^2$ 1

Area of remaining sheet of paper = 1120 – 308 = 812 $cm^2$ 1

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**28. Given that $\sqrt{3}$ is irrational, prove that $5\sqrt{3}-2$ is an irrational number.**

**Sol.** Let $5\sqrt{3}-2$ is rational

Let $5\sqrt{3}-2$ = x 1

$\therefore\ \sqrt{3} = \frac{x+2}{5}$ 1

Clearly RHS is rational but LHS is irrational (given)

$\therefore$ Our supposition is wrong hence $5\sqrt{3}-2$ is irrational 1

**OR**

**There is a circular path around a sports field. Sonia takes 18 minutes for one round of the field and Ravi takes 12 minutes for the same. Suppose they both start from the same point and at the same time. After how many minutes will they meet again at the starting point?**

LCM of 12 and 18 = 36 2

$\therefore$ They will meet again after 36 minutes 1

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**29.** **Find the zeroes of the quadratic polynomial $6x^2 + x - 2$ and verify the relationship between the zeroes and the coefficients.**

**Sol.** Zeroes are $\frac{1}{2}, -\frac{2}{3}$ $\frac{1}{2}+\frac{1}{2}$

Sum of zeroes = $\frac{1}{2}-\frac{2}{3}=-\frac{1}{6}$, Also $-\frac{b}{a}=-\frac{1}{6}$ $\Rightarrow$ Sum of zeroes = $\frac{-b}{a}$ $\frac{1}{2}+\frac{1}{2}$

Product of zeroes = $\frac{1}{2}\times\frac{-2}{3}=\frac{-1}{3}$, Also $\frac{c}{a}=\frac{-2}{6}=\frac{-1}{3}$ $\Rightarrow$ Product of zeroes = $\frac{c}{a}$ $\frac{1}{2}+\frac{1}{2}$

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**30.** **Prove that $\frac{\tan\theta - \cot\theta}{\sin\theta\cos\theta} = \tan^2\theta - \cot^2\theta$.**

**Sol.** LHS = $\frac{\frac{\sin\theta}{\cos\theta}-\frac{\cos\theta}{\sin\theta}}{\sin\theta\cos\theta} = \frac{\sin^2\theta-\cos^2\theta}{\sin^2\theta\cos^2\theta}$ $\frac{1}{2}+\frac{1}{2}$

$= \frac{1}{\cos^2\theta}-\frac{1}{\sin^2\theta}$ $\frac{1}{2}$

$= \sec^2\theta - \text{cosec}^2\theta$ $\frac{1}{2}$

$= (1+\tan^2\theta) - (1+\cot^2\theta)$ $\frac{1}{2}$

$= \tan^2\theta - \cot^2\theta$ = RHS $\frac{1}{2}$

**OR**

**Prove that $\frac{\text{cosec}\,A}{\text{cosec}\,A-1}+\frac{\text{cosec}\,A}{\text{cosec}\,A+1} = 2 + 2\tan^2 A$.**

$$\text{LHS} = \frac{\text{cosec}^2\text{A} + \text{cosec A} + \text{cosec}^2\text{A} - \text{cosec A}}{\text{cosec}^2\text{A} - 1}$$ 1

$$= \frac{2\,\text{cosec}^2\text{A}}{\cot^2 \text{A}}$$ 1

$$= \frac{2}{\sin^2 \text{A}} \times \frac{\sin^2 \text{A}}{\cos^2 \text{A}} = 2\,\sec^2 \text{A}$$

$= 2(1 + \tan^2\text{A})$

$= 2 + 2\,\tan^2\text{A} = \text{RHS}$ 1

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**31. From a point 6 cm away from the centre of a circle of radius 3 cm, write the steps of construction for constructing a pair of tangents to the circle.**

**Sol.** Writing relevant steps 3

**OR**

**Write the steps of construction for dividing a line segment of length 6 cm in the ratio of 3 : 2.**

Writing relevant steps 3

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**32. The coordinates of the mid-point P of the line segment joining the points A(3p, 4) and B(– 2, 2q) are (5, p). Find the values of p and q.**

**Sol.** $\frac{3p-2}{2} = 5 \Rightarrow p = 4$ $1+\frac{1}{2}$

$\frac{4+2q}{2} = p = 4 \Rightarrow q = 2$ $1+\frac{1}{2}$

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**33. Prove that if a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then the other two sides are divided in the same ratio.**

**Sol.** For correct given, To prove, figure $1\frac{1}{2}$

For correct proof $1\frac{1}{2}$

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**34. Solve for x and y:**

**4x + 3y = 72; x + 3y = 36.**

**Also find the value of p if 2x = py.**

**Sol.** Solving given equations, we get x = 12 1

and y = 8 1

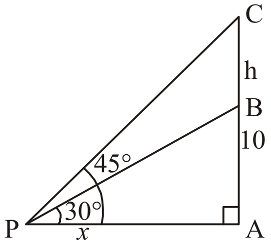
Putting values of x & y in 2x = py we get p = 3 1

## SECTION D

**Question numbers 35 to 40 carry 4 marks each.**

**35. From a point P on the ground, the angle of elevation of the top of a 10 m tall building is 30°. A flagstaff is fixed at the top of the building and the angle of elevation of the top of the flagstaff from P is 45°. Find the length of the flagstaff and the distance of point P from the building. (Take $\sqrt{3}$ = 1.732).**

**Sol.** Let height of flagstaff = h m



$\therefore$ total height of flagstaff & building = (h + 10) m

$$\frac{h+10}{x} = \tan 45°$$ 1

$\Rightarrow x = h + 10$ 1

$$\therefore \frac{10}{h+10} = \tan 30°$$ 1

$h = 10(\sqrt{3}-1)\,m = 7.32\,m$ 1

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**36. A solid sphere of radius 10.5 cm is melted and recast into smaller cones of radius 3.5 cm and height 3 cm. Find the number of cones so formed.**

**Sol.** $$\frac{4}{3}\pi \times 10.5 \times 10.5 \times 10.5 = n \times \frac{1}{3}\pi \times 3.5 \times 3.5 \times 3$$ $1\frac{1}{2}+1\frac{1}{2}$

$\Rightarrow n = 126$ 1

**OR**

**The surface area of a solid metallic sphere is 616 cm$^2$. It is melted and recast into a cone of height 28 cm. Find the diameter of the base of the cone so formed.**

$4\pi r^2 = 616 \Rightarrow r = 7$ cm 1

$$\frac{4}{3}\pi \times 7 \times 7 \times 7 = \frac{1}{3}\pi r^2 \times 28$$ 1+1

$\Rightarrow r = 7$ cm $\frac{1}{2}$

$\therefore$ diameter = 14 cm $\frac{1}{2}$

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**37. Prove that the lengths of tangents drawn from an external point to a circle are equal.**

**Sol.** For correct, Given, To prove 1

For correct proof 3

**OR**

**Prove that in a triangle, if the square of one side is equal to the sum of the squares of the other two sides, then the angle opposite to the first side is a right angle.**

For correct given and to prove 1

For correct proof 3

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**38. The 10th term of an AP is 29 and the sum of its first 20 terms is 610. Find the sum of its first 30 terms.**

**Sol.** Let first term = a & common difference = d

$a + 9d = 29$ ...(i) $\frac{1}{2}$

$10(2a + 19d) = 610 \Rightarrow 2a + 19d = 61$ ...(ii) 1

Solving (i) & (ii) we get d = 3 $\frac{1}{2}$

$a = 2$ $\frac{1}{2}$

$S_{30} = 15(4 + 87) = 15 \times 91$ 1

$= 1365$ $\frac{1}{2}$

**OR**

**The sum of the first 3 terms of an A.P. is 21 and the sum of their squares is 155. Find the A.P.**

Let the terms be $a - d, a, a + d$ $\frac{1}{2}$

$a - d + a + a + d = 21 \Rightarrow a = 7$ 1

$(7 - d)^2 + 7^2 + (7 + d)^2 = 155$ $\frac{1}{2}$

$\Rightarrow 49 + d^2 = 53$ $\frac{1}{2}$

$d^2 = 4$

d = +2 or –2 1

Required A.P. is 5, 7, 9, ... or 9, 7, 5, ... $\frac{1}{2}$

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**39. Three consecutive positive integers are such that the sum of the square of the first and product of the other two is 46. Find the integers.**

**Sol.** Let 3 consecutive integers be x, x + 1, x + 2 $\frac{1}{2}$

According to question,

$x^2 + (x + 1)(x + 2) = 46$ 1

$\Rightarrow 2x^2 + 3x - 44 = 0$

$\Rightarrow (2x + 11)(x - 4) = 0$ 1

$\therefore x = 4$ $\frac{1}{2}$

Integers are 4, 5, 6 1

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**40. In an apple orchard, the number of apples on 50 trees is given below:**

| **Number of apples** | **50 – 60** | **60 – 70** | **70 – 80** | **80 – 90** | **90 – 100** |
|---|---|---|---|---|---|
| **Number of trees** | **12** | **18** | **10** | **6** | **4** |

**Find the mean number of apples on a tree in the orchard.**

**Sol.**

| Classes | $x_i$ | $f_i$ | $u_i$ | $f_iu_i$ |
|---|---|---|---|---|
| 50 – 60 | 55 | 12 | –2 | –24 |
| 60 – 70 | 65 | 18 | –1 | –18 |
| 70 – 80 | 75 | 10 | 0 | 0 |
| 80 – 90 | 85 | 6 | 1 | 6 |
| 90 – 100 | 95 | 4 | 2 | 8 |
| | | 50 | | –28 |

Correct Table 2

Let a = 75

$$\overline{x} = a + \frac{\Sigma\, fiui}{\Sigma\, fi} \times h$$

$$= 75 - \frac{28}{50} \times 10$$ 1

$= 69.4$ 1