

**Strictly Confidential: (For Internal and Restricted use only)**  
**Secondary School Examination**  
**March 2019**  
**Marking Scheme – MATHEMATICS ( SUBJECT CODE -041 )**

**PAPER CODE: 30/1/1, 30/1/2, 30/1/3**

**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 efforts in 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.**
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. 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.
5. If a question does not have any parts, marks must be awarded in the left hand margin and encircled.
6. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.
7. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
8. A full scale of marks **1-80** has to be used. Please do not hesitate to award full marks if the answer deserves it.
9. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 25 answer books per day.
10. 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 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.

11. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (X) and awarded zero (0) Marks.
12. 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.
13. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.
14. 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.
15. 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 30/1/1  
**EXPECTED ANSWER/VALUE POINTS**

**SECTION A**

1. Let the point A be (x, y)

$$\therefore \frac{1+x}{2} = 2 \text{ and } \frac{4+y}{2} = -3$$

$$\Rightarrow x = 3 \text{ and } y = -10$$

$$\therefore \text{ Point A is } (3, -10)$$

2. Since roots of the equation  $x^2 + 4x + k = 0$  are real

$$\Rightarrow 16 - 4k \geq 0$$

$$\Rightarrow k \leq 4$$

OR

Roots of the equation  $3x^2 - 10x + k = 0$  are reciprocal of each other

$$\Rightarrow \text{Product of roots} = 1$$

$$\Rightarrow \frac{k}{3} = 1 \Rightarrow k = 3$$

3.  $\tan 2A = \cot (90^\circ - 2A)$

$$\therefore 90^\circ - 2A = A - 24^\circ$$

$$\Rightarrow A = 38^\circ$$

OR

$$\sin 33^\circ = \cos 57^\circ$$

$$\therefore \sin^2 33^\circ + \sin^2 57^\circ = \cos^2 57^\circ + \sin^2 57^\circ = 1$$

4. Numbers are 12, 15, 18, ..., 99

 $\frac{1}{2}$ 

$$\therefore 99 = 12 + (n - 1) \times 3$$

$$\Rightarrow n = 30$$

 $\frac{1}{2}$ 

5.  $AB = 1 + 2 = 3$  cm

 $\frac{1}{2}$ 

$\triangle ABC \sim \triangle ADE$

$$\therefore \frac{\text{ar}(\triangle ABC)}{\text{ar}(\triangle ADE)} = \frac{AB^2}{AD^2} = \frac{9}{1}$$

 $\frac{1}{2}$ 

$$\therefore \text{ar}(\triangle ABC) : \text{ar}(\triangle ADE) = 9 : 1$$

6. Any one rational number between  $\sqrt{2}$  (1.41 approx.) and  $\sqrt{3}$  (1.73 approx.)

1

e.g., 1.5, 1.6, 1.63 etc.

### SECTION B

7. Using Euclid's Algorithm

$$\left. \begin{aligned} 7344 &= 1260 \times 5 + 1044 \\ 1260 &= 1044 \times 1 + 216 \\ 1044 &= 216 \times 4 + 180 \\ 216 &= 180 \times 1 + 36 \\ 180 &= 36 \times 5 + 0 \end{aligned} \right\}$$

 $1\frac{1}{2}$ 

HCF of 1260 and 7344 is 36.

 $\frac{1}{2}$ 

OR

Using Euclid's Algorithm

$$a = 4q + r, 0 \leq r < 4$$

$$\Rightarrow a = 4q, a = 4q + 1, a = 4q + 2 \text{ and } a = 4q + 3.$$

1

Now  $a = 4q$  and  $a = 4q + 2$  are even numbers.

 $\frac{1}{2}$ 

Therefore when  $a$  is odd, it is of the form

$$a = 4q + 1 \text{ or } a = 4q + 3 \text{ for some integer } q.$$

 $\frac{1}{2}$

$$8. \quad a_n = a_{21} + 120$$

$$= (3 + 20 \times 12) + 120$$

$$= 363$$

$$\therefore 363 = 3 + (n - 1) \times 12$$

$$\Rightarrow n = 31$$

or 31st term is 120 more than  $a_{21}$ .

OR

$$a_1 = S_1 = 3 - 4 = -1$$

$$a_2 = S_2 - S_1 = [3(2)^2 - 4(2)] - (-1) = 5$$

$$\therefore d = a_2 - a_1 = 6$$

$$\text{Hence } a_n = -1 + (n - 1) \times 6 = 6n - 7$$

**Alternate method:**

$$S_n = 3n^2 - 4n$$

$$\therefore S_{n-1} = 3(n-1)^2 - 4(n-1) = 3n^2 - 10n + 7$$

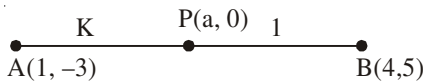
$$\text{Hence } a_n = S_n - S_{n-1}$$

$$= (3n^2 - 4n) - (3n^2 - 10n + 7)$$

$$= 6n - 7$$

9.

Let the required point be  $(a, 0)$  and required ratio  $AP : PB = k : 1$



$$\therefore a = \frac{4k + 1}{k + 1}$$

$$0 = \frac{5k - 3}{k + 1}$$

$$\Rightarrow k = \frac{3}{5} \text{ or required ratio is } 3 : 5$$

$$\text{Point P is } \left( \frac{17}{8}, 0 \right)$$

10. Total number of outcomes = 8

 $\frac{1}{2}$ 

Favourable number of outcomes (HHH, TTT) = 2

 $\frac{1}{2}$ 

Prob. (getting success) =  $\frac{2}{8}$  or  $\frac{1}{4}$

 $\frac{1}{2}$ 

$\therefore$  Prob. (losing the game) =  $1 - \frac{1}{4} = \frac{3}{4}$ .

 $\frac{1}{2}$ 

11. Total number of outcomes = 6.

(i) Prob. (getting a prime number (2, 3, 5)) =  $\frac{3}{6}$  or  $\frac{1}{2}$

1

(ii) Prob. (getting a number between 2 and 6 (3, 4, 5)) =  $\frac{3}{6}$  or  $\frac{1}{2}$ .

1

12. System of equations has infinitely many solutions

$$\therefore \frac{c}{12} = \frac{3}{c} = \frac{3-c}{-c}$$

 $\frac{1}{2}$ 

$$\Rightarrow c^2 = 36 \Rightarrow c = 6 \text{ or } c = -6 \quad \dots(1)$$

 $\frac{1}{2}$ 

$$\text{Also } -3c = 3c - c^2 \Rightarrow c = 6 \text{ or } c = 0 \quad \dots(2)$$

 $\frac{1}{2}$ 

From equations (1) and (2)

$$c = 6.$$

 $\frac{1}{2}$ 

### SECTION C

13. Let us assume  $\sqrt{2}$  be a rational number and its simplest form be  $\frac{a}{b}$ , a and b are coprime positive integers and  $b \neq 0$ .

$$\text{So } \sqrt{2} = \frac{a}{b}$$

$$\Rightarrow a^2 = 2b^2$$

1

Thus  $a^2$  is a multiple of 2

$$\Rightarrow a \text{ is a multiple of } 2.$$

 $\frac{1}{2}$ 

Let  $a = 2m$  for some integer  $m$

$$\therefore b^2 = 2m^2$$

 $\frac{1}{2}$ 

Thus  $b^2$  is a multiple of 2

$\Rightarrow b$  is a multiple of 2

 $\frac{1}{2}$ 

Hence 2 is a common factor of  $a$  and  $b$ .

This contradicts the fact that  $a$  and  $b$  are coprimes

Hence  $\sqrt{2}$  is an irrational number.

 $\frac{1}{2}$ 

14. Sum of zeroes =  $k + 6$

1

Product of zeroes =  $2(2k - 1)$

1

$$\text{Hence } k + 6 = \frac{1}{2} \times 2(2k - 1)$$

$$\Rightarrow k = 7$$

1

15. Let sum of the ages of two children be  $x$  yrs and father's age be  $y$  yrs.

$$\therefore y = 3x \quad \dots(1)$$

1

$$\text{and } y + 5 = 2(x + 10) \quad \dots(2)$$

1

Solving equations (1) and (2)

$$x = 15$$

$$\text{and } y = 45$$

Father's present age is 45 years.

1

OR

Let the fraction be  $\frac{x}{y}$

$$\therefore \frac{x-2}{y} = \frac{1}{3} \quad \dots(1)$$

1

$$\text{and } \frac{x}{y-1} = \frac{1}{2} \quad \dots(2)$$

1

Solving (1) and (2) to get  $x = 7$ ,  $y = 15$ .

$$\therefore \text{Required fraction is } \frac{7}{15}$$

1

16. Let the required point on y-axis be (0, b)

$$\therefore (5 - 0)^2 + (-2 - b)^2 = (-3 - 0)^2 + (2 - b)^2$$

$$\Rightarrow 29 + 4b + b^2 = 13 + b^2 - 4b$$

$$\Rightarrow b = -2$$

$\therefore$  Required point is (0, -2)

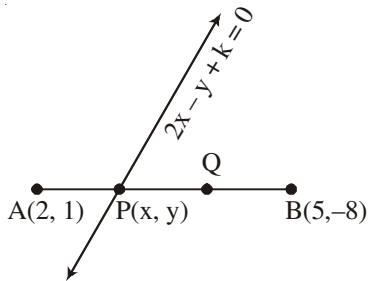
 $\frac{1}{2}$ 

1

1

 $\frac{1}{2}$ 

OR



$$AP : PB = 1 : 2$$

$$x = \frac{4+5}{3} = 3 \text{ and } y = \frac{2-8}{3} = -2$$

Thus point P is (3, -2).

Point (3, -2) lies on  $2x - y + k = 0$

$$\Rightarrow 6 + 2 + k = 0$$

$$\Rightarrow k = -8.$$

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

1

17. LHS =  $\sin^2 \theta + \operatorname{cosec}^2 \theta + 2\sin \theta \operatorname{cosec} \theta + \cos^2 \theta + \sec^2 \theta + 2\cos \theta \sec \theta$

$$= (\sin^2 \theta + \cos^2 \theta) + \operatorname{cosec}^2 \theta + \sec^2 \theta + \frac{2\sin \theta}{\sin \theta} + 2\frac{\cos \theta}{\cos \theta}$$

$$= 1 + 1 + \cot^2 \theta + 1 + \tan^2 \theta + 2 + 2$$

$$= 7 + \cot^2 \theta + \tan^2 \theta = \text{RHS}$$

1

 $1 \frac{1}{2}$  $\frac{1}{2}$ 

OR

$$\text{LHS} = \left( 1 + \frac{1}{\tan A} - \operatorname{cosec} A \right) (1 + \tan A + \sec A)$$

$$= \frac{1}{\tan A} (\tan A + 1 - \sec A) (1 + \tan A + \sec A)$$

$$= \frac{1}{\tan A} [(1 + \tan A)^2 - \sec^2 A]$$

$$= \frac{1}{\tan A} [1 + \tan^2 A + 2\tan A - 1 - \tan^2 A]$$

$$= 2 = \text{RHS}$$

1

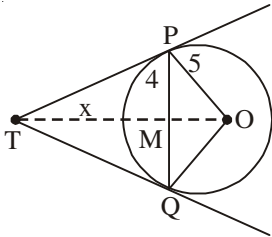
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1

## Alternate method

$$\begin{aligned}
 \text{LHS} &= \left(1 + \frac{\cos A}{\sin A} - \frac{1}{\sin A}\right) \left(1 + \frac{\sin A}{\cos A} + \frac{1}{\cos A}\right) && 1 \\
 &= (\sin A + \cos A - 1)(\cos A + \sin A + 1) \cdot \frac{1}{\cos A \sin A} \\
 &= [(\sin A + \cos A)^2 - 1] \times \frac{1}{\sin A \cos A} && 1 \\
 &= (1 + 2 \sin A \cos A - 1) \times \frac{1}{\sin A \cos A} && \frac{1}{2} \\
 &= 2 = \text{RHS} && \frac{1}{2}
 \end{aligned}$$

18.



Join OT and OQ.

$$TP = TQ$$

 $\therefore TM \perp PQ$  and bisects PQ
Hence  $PM = 4$  cm

$$\text{Therefore } OM = \sqrt{25 - 16} = \sqrt{9} = 3 \text{ cm.}$$

Let  $TM = x$ 

$$\text{From } \triangle PMT, \quad PT^2 = x^2 + 16$$

$$\text{From } \triangle POT, \quad PT^2 = (x + 3)^2 - 25$$

$$\text{Hence } x^2 + 16 = x^2 + 9 + 6x - 25$$

$$\Rightarrow 6x = 32 \Rightarrow x = \frac{16}{3}$$

$$\text{Hence } PT^2 = \frac{256}{9} + 16 = \frac{400}{9}$$

$$\therefore PT = \frac{20}{3} \text{ cm.}$$

19.  $\triangle ACB \sim \triangle ADC$  (AA similarity)

$$\Rightarrow \frac{AC}{BC} = \frac{AD}{CD} \quad \dots(1) \quad 1$$

Also  $\triangle ACB \sim \triangle CDB$  (AA similarity)

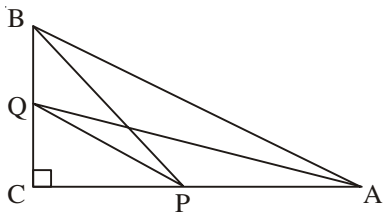
$$\Rightarrow \frac{AC}{BC} = \frac{CD}{BD} \quad \dots(2) \quad 1$$

Using equations (1) and (2)

$$\frac{AD}{CD} = \frac{CD}{BD}$$

$$\Rightarrow CD^2 = AD \times BD \quad 1$$

OR



Correct Figure

$$AQ^2 = CQ^2 + AC^2 \quad 1$$

$$BP^2 = CP^2 + BC^2 \quad \frac{1}{2}$$

$$\therefore AQ^2 + BP^2 = (CQ^2 + CP^2) + (AC^2 + BC^2)$$

$$= PQ^2 + AB^2. \quad 1$$

20.  $AC = \sqrt{64 + 36} = 10$  cm.

$\therefore$  Radius of the circle (r) = 5 cm. 1

Area of shaded region = Area of circle – Ar(ABCD)  $\frac{1}{2}$

$$= 3.14 \times 25 - 6 \times 8 \quad 1$$

$$= 78.5 - 48$$

$$= 30.5 \text{ cm}^2. \quad \frac{1}{2}$$

21. Length of canal covered in 30 min = 5000 m.  $\frac{1}{2}$

$\therefore$  Volume of water flown in 30 min =  $6 \times 1.5 \times 5000 \text{ m}^3$  1

If 8 cm standing water is needed

$$\text{then area irrigated} = \frac{6 \times 1.5 \times 5000}{.08} = 562500 \text{ m}^2.$$

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

22. Modal class is 30-40

 $\frac{1}{2}$ 

$$\therefore \text{ Mode} = l + \left( \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

$$= 30 + \left( \frac{16 - 10}{32 - 10 - 12} \right) \times 10$$

2

$$= 36.$$

 $\frac{1}{2}$ 

### SECTION D

23. Let the smaller tap fills the tank in x hrs

$\therefore$  the larger tap fills the tank in (x - 2) hrs.

Time taken by both the taps together =  $\frac{15}{8}$  hrs.

$$\text{Therefore } \frac{1}{x} + \frac{1}{x-2} = \frac{8}{15}$$

2

$$\Rightarrow 4x^2 - 23x + 15 = 0$$

 $\frac{1}{2}$ 

$$\Rightarrow (4x - 3)(x - 5) = 0$$

$$x \neq \frac{3}{4} \quad \therefore x = 5$$

1

Smaller and larger taps can fill the tank separately in 5 hrs and 3 hrs resp.

 $\frac{1}{2}$ 

OR

Let the speed of the boat in still water be x km/hr and speed of the stream be y km/hr.

$$\text{Given } \frac{30}{x-y} + \frac{44}{x+y} = 10 \quad \dots(i)$$

1

$$\text{and } \frac{40}{x-y} + \frac{55}{x+y} = 13 \quad \dots(ii)$$

1

Solving (i) and (ii) to get

$$x + y = 11 \quad \dots(\text{iii})$$

and  $x - y = 5 \quad \dots(\text{iv})$

Solving (iii) and (iv) to get  $x = 8, y = 3$ .

1+1

Speed of boat = 8 km/hr & speed of stream = 3 km/hr.

24.  $S_4 = 40 \Rightarrow 2(2a + 3d) = 40 \Rightarrow 2a + 3d = 20 \quad 1$

$S_{14} = 280 \Rightarrow 7(2a + 13d) = 280 \Rightarrow 2a + 13d = 40 \quad 1$

Solving to get  $d = 2$

 $\frac{1}{2}$ 

and  $a = 7$

 $\frac{1}{2}$ 

$$\therefore S_n = \frac{n}{2}[14 + (n-1) \times 2]$$

$$= n(n+6) \text{ or } (n^2 + 6n)$$

1

25.  $\text{LHS} = \frac{\sin A - \cos A + 1}{\sin A + \cos A - 1}$

Dividing num. & deno. by  $\cos A$

$$= \frac{\tan A - 1 + \sec A}{\tan A + 1 - \sec A}$$

1

$$= \frac{\tan A - 1 + \sec A}{(\tan A - \sec A) + (\sec^2 A - \tan^2 A)}$$

1

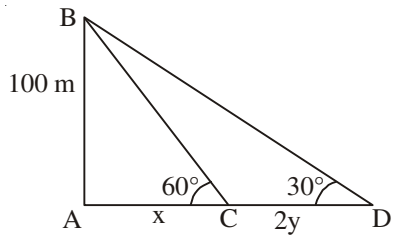
$$= \frac{\tan A - 1 + \sec A}{(\tan A - \sec A)(1 - \sec A - \tan A)}$$

1

$$= \frac{-1}{\tan A - \sec A} = \frac{1}{\sec A - \tan A} = \text{RHS}$$

1

26.



Correct Figure

1

Let the speed of the boat be  $y$  m/min

$$\therefore CD = 2y$$

$$\tan 60^\circ = \sqrt{3} = \frac{100}{x} \Rightarrow x = \frac{100}{\sqrt{3}}$$

1

$$\tan 30^\circ = \frac{1}{\sqrt{3}} = \frac{100}{x + 2y} \Rightarrow x + 2y = 100\sqrt{3}$$

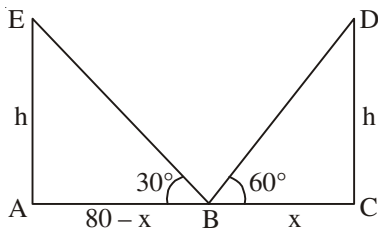
1

$$\therefore y = \frac{100\sqrt{3}}{3} = 57.73$$

1

or speed of boat = 57.73 m/min.

OR



Correct Figure

1

Let  $BC = x$  so  $AB = 80 - x$ where  $AC$  is the road.

$$\tan 60^\circ = \sqrt{3} = \frac{h}{x} \Rightarrow h = x\sqrt{3}$$

1

$$\text{and } \tan 30^\circ = \frac{1}{\sqrt{3}} = \frac{h}{80 - x} \Rightarrow h\sqrt{3} = 80 - x$$

1

Solving equation to get

$$x = 20, h = 20\sqrt{3}$$

$$\therefore AB = 60 \text{ m, } BC = 20 \text{ m and } h = 20\sqrt{3} \text{ m.}$$

1

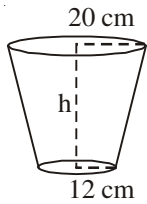
27. Correct construction of  $\triangle ABC$ .

2

Correct construction of triangle similar to triangle ABC.

2

28.

Volume of the bucket =  $12308.8 \text{ cm}^3$ Let  $r_1 = 20 \text{ cm}$ ,  $r_2 = 12 \text{ cm}$ 

$$\therefore V = \frac{\pi h}{3}(r_1^2 + r_2^2 + r_1 r_2)$$

$$\therefore 12308.8 = \frac{3.14 \times h}{3}(400 + 144 + 240) \quad 1$$

$$\Rightarrow h = \frac{12308.8 \times 3}{3.14 \times 784} = 15 \text{ cm} \quad 1$$

$$\text{Now } l^2 = h^2 + (r_1 - r_2)^2 = 225 + 64 = 289$$

$$\Rightarrow l = 17 \text{ cm.} \quad 1$$

Surface area of metal sheet used =  $\pi r_2^2 + \pi l (r_1 + r_2)$ 

$$= 3.14 (144 + 17 \times 32)$$

$$= 2160.32 \text{ cm}^2. \quad 1$$

29. Correct given, to prove, figure and construction

$$\frac{1}{2} \times 4 = 2$$

Correct proof.

2

30.	Class	Frequency	Cumulative freq.
	0-10	$f_1$	$f_1$
	10-20	5	$5 + f_1$
	20-30	9	$14 + f_1$
	30-40	12	$26 + f_1$
	40-50	$f_2$	$26 + f_1 + f_2$
	50-60	3	$29 + f_1 + f_2$
	60-70	2	$31 + f_1 + f_2$

Correct Table 1

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 40
 

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Median = 32.5  $\Rightarrow$  median class is 30-40.

$$\frac{1}{2}$$

$$\text{Now } 32.5 = 30 + \frac{10}{12}(20 - 14 - f_1)$$

1

$$\Rightarrow f_1 = 3$$

1

$$\text{Also } 31 + f_1 + f_2 = 40$$

$$\Rightarrow f_2 = 6$$

$$\frac{1}{2}$$

30/1/1

OR

Less than type distribution is as follows

Marks	No. of students
Less than 5	2
Less than 10	7
Less than 15	13
Less than 20	21
Less than 25	31
Less than 30	56
Less than 35	76
Less than 40	94
Less than 45	98
Less than 50	100

Correct Table  $1\frac{1}{2}$

Plotting of points (5, 2), (10, 7), (15, 13), (20, 21), (25, 31), (30, 56),

(35, 76), (40, 94), (45, 98), (50, 100)

$1\frac{1}{2}$

Joining to get the curve

$\frac{1}{2}$

Getting median from graph (approx. 29)

$\frac{1}{2}$