## Class- X

### Mathematics-Basic (241)

**Marking Scheme SQP-2020-21**

Max. Marks: 80 Duration: 3hrs

<table>
<thead>
<tr>
<th>Qtn No.</th>
<th>Question</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$156 = 2^2 \times 3 \times 13$</td>
<td>1</td>
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<tr>
<td>2</td>
<td>Quadratic polynomial is given by $x^2 - (a+b)x + ab$</td>
<td>1</td>
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<td></td>
<td>$x^2 - 2x - 8$</td>
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<tr>
<td>3</td>
<td>HCF X LCM = product of two numbers</td>
<td>1/2</td>
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<td></td>
<td>LCM $(96,404) = \frac{96 \times 404}{HCF(96,404)} = \frac{96 \times 404}{4}$</td>
<td>1/2</td>
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<tr>
<td></td>
<td>$\text{LCM} = 9696$</td>
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<tr>
<td></td>
<td><strong>OR</strong></td>
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<td>Every composite number can be expressed (factorized) as a product of primes, and this factorization is unique, apart from the order in which the factors occur.</td>
<td>1</td>
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<tr>
<td>4</td>
<td>$x - 2y = 0$</td>
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<tr>
<td></td>
<td>$3x + 4y - 20 = 0$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\frac{1}{3} \neq \frac{-2}{4}$</td>
<td>1/2</td>
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<tr>
<td></td>
<td>As, $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ is one condition for consistency.</td>
<td>1/2</td>
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<tr>
<td></td>
<td>Therefore, the pair of equations is consistent.</td>
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<tr>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>$\theta = 60^\circ$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Area of sector $= \frac{\theta}{360^\circ} \pi r^2$</td>
<td>1/2</td>
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<tr>
<td></td>
<td>$A = \frac{60^\circ}{360^\circ} \times \frac{22}{7} \times (6)^2 \text{cm}^2$</td>
<td>1/2</td>
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<tr>
<td></td>
<td>$A = \frac{1}{6} \times \frac{22}{7} \times 36 \text{ cm}^2$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$= 18.86 \text{ cm}^2$</td>
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</table>
**OR**

Another method-
Horse can graze in the field which is a circle of radius 28 cm.
So, required perimeter $= 2\pi r = 2\pi(28) cm$
\[
= 2 \times \frac{22}{7} \times 28 \text{ cm} = 176 \text{ cm}
\]

| 7 | By converse of Thale’s theorem DE II BC 
|   | $\angle ADE = \angle ABC = 70^\circ$ 
|   | Given $\angle BAC = 50^\circ$ 
|   | $\angle ABC + \angle BAC + \angle BCA = 180^\circ$ (Angle sum prop of triangles) 
|   | $70^\circ + 50^\circ + \angle BCA = 180^\circ$ 
|   | $\angle BCA = 180^\circ - 120^\circ = 60^\circ$

**OR**

\[
EC = AC - AE = (7 - 3.5) \text{ cm} = 3.5 \text{ cm}
\]
\[
\frac{AD}{BD} = \frac{2}{3} \text{ and } \frac{AE}{EC} = \frac{3.5}{3.5} = \frac{1}{1}
\]

So, $\frac{AD}{BD} = \frac{AE}{EC}$

Hence, By converse of Thale’s Theorem, DE is not Parallel to BC.

| 8 | Length of the fence $= \frac{\text{Total cost}}{\text{Rate}} = \frac{\text{Rs.5280}}{\text{Rs.24/metre}} = 220 \text{ m}$ 
|   | So, length of fence = Circumference of the field 
|   | $\therefore 220 \text{ m} = 2 \pi r = 2 \times \frac{22}{7} \times r$ 
|   | So, $r = \frac{220 \times 7}{2 \times 22} \text{ m} = 35 \text{ m}$

| 9 | Sol: $\tan 30^\circ = \frac{AB}{BC}$ 
|   | $\frac{1}{\sqrt{3}} = \frac{AB}{8}$ 
|   | $AB = 8 / \sqrt{3} \text{ metres}$ 
|   | Height from where it is broken is $8\sqrt{3} \text{ metres}$

| 1/2 |
10. Perimeter = Area
   $2\pi r = \pi r^2$
   $r = 2$ units

11. 3 median = mode + 2 mean

12. $8$

13. $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ is the condition for the given pair of equations to have unique solution.

   $\frac{4}{2} \neq \frac{p}{2}$
   $p \neq 4$

   Therefore, for all real values of $p$ except 4, the given pair of equations will have a unique solution.

   OR

   Here, $\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}$
   $\frac{b_1}{b_2} = \frac{3}{6} = \frac{1}{2}$ and $\frac{c_1}{c_2} = \frac{5}{7}$
   $\frac{1}{2} = \frac{1}{2} \neq \frac{5}{7}$

   $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ is the condition for which the given system of equations will represent parallel lines.

   So, the given system of linear equations will represent a pair of parallel lines.

14. No. of red balls = 3, No. black balls = 5
   Total number of balls = $5 + 3 = 8$
   Probability of red balls $= \frac{3}{8}$

   OR

   Total no of possible outcomes = 6
   There are 3 Prime numbers, 2,3,5.
   So, Probability of getting a prime number is $\frac{3}{6} = \frac{1}{2}$
15

\[ \tan 60^\circ = \frac{h}{15} \]
\[ \sqrt{3} = \frac{h}{15} \]
\[ h = 15\sqrt{3} \text{ m} \]

16 i)
Ans: b)
Cloth material required = 2X S A of hemispherical dome
= 2 \times 2\pi r^2
= 2 \times 2 \times \frac{22}{7} \times (2.5)^2 \text{ m}^2
= 78.57 \text{ m}^2

ii) a) Volume of a cylindrical pillar = \pi r^2h

iii) b) Lateral surface area = 2\pi rh
= 4 \times \frac{22}{7} \times 1.4 \times 7 \text{ m}^2
= 123.2 \text{ m}^2

iv) d) Volume of hemisphere \( \frac{2}{3} \pi r^3 \)
= \( \frac{2}{3} \times \frac{22}{7} \times (3.5)^3 \) m\(^3\)
= 89.83 m\(^3\)

v) b)
Sum of the volumes of two hemispheres of radius 1cm each = 2 \times \frac{2}{3} \pi 1^3
Volume of sphere of radius 2cm = \( \frac{4}{3} \pi 2^3 \)
So, required ratio is \( \frac{2 \times \frac{2}{3} \pi 1^3}{\frac{4}{3} \pi 2^3} = 1:8 \)
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<tbody>
<tr>
<td>18</td>
<td>i)</td>
<td>c) (0,0)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>ii)</td>
<td>a) (4,6)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>iii)</td>
<td>a) (6,5)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>iv)</td>
<td>a) (16,0)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>v)</td>
<td>b) (-12,6)</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>i)</td>
<td>c) 90°</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>ii)</td>
<td>b) SAS</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>iii)</td>
<td>b) 4 : 9</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>iv)</td>
<td>d) Converse of Pythagoras theorem</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>v)</td>
<td>a) 48 cm²</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>i)</td>
<td>d) parabola</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>ii)</td>
<td>a) 2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>iii)</td>
<td>b) -1, 3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>iv)</td>
<td>c) $x^2 - 2x - 3$</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>v)</td>
<td>d) 0</td>
<td>1</td>
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</table>

21 Let P(x,y) be the required point. Using section formula

$$\left( \frac{m_1x_2+m_2x_1}{m_1+m_2}, \frac{m_1y_2+m_2y_1}{m_1+m_2} \right) = (x, y)$$

$$x = \frac{3(8)+1(4)}{3+1}, \quad y = \frac{3(5)+1(-3)}{3+1}$$

$$x = 7, \quad y = 3$$

(7,3) is the required point

1
Let P(x, y) be equidistant from the points A(7,1) and B(3,5)
Given AP = BP. So, AP² = BP²
\((x-7)^2 + (y-1)^2 = (x-3)^2 + (y-5)^2\)
\(x^2 -14x + 49 + y^2 - 2y + 1 = x^2 - 6x + 9 + y^2 - 10y + 25\)
\(x - y = 2\)

By BPT,
\[
\frac{AM}{MB} = \frac{AL}{LC} \quad \text{...........(1)}
\]
Also, \(\frac{AN}{ND} = \frac{AL}{LC} \quad \text{...........(2)}\)

By Equating (1) and (2) \(\frac{AM}{MB} = \frac{AN}{ND}\)

To prove: AB + CD = AD + BC.

Proof: AS = AP (Length of tangents from an external point to a circle are equal)
\(BQ = BP\)
\(CQ = CR\)
\(DS = DR\)
\(AS + BQ + CQ + DS = AP + BP + CR + DR\)
\((AS + DS) + (BQ + CQ) = (AP + BP) + (CR + DR)\)
\(AD + BC = AB + CD\)

For the correct construction
15 cot A = 8, find sin A and sec A.

Cot A = 8/15

By Pythagoras Theorem

\[ AC^2 = AB^2 + BC^2 \]

\[ AC = \sqrt{(8x)^2 + (15x)^2} \]

\[ AC = 17x \]

\[ \sin A = \frac{15}{17} \]

\[ \cos A = \frac{8}{17} \]

OR

By Pythagoras Theorem

\[ QR = \sqrt{(13)^2 - (12)^2} \text{ cm} \]

\[ QR = 5 \text{ cm} \]

\[ \tan P = \frac{5}{12} \]

\[ \cot R = \frac{5}{12} \]

\[ \tan P - \cot R = \frac{5}{12} - \frac{5}{12} = 0 \]

9, 17, 25, .......

\[ S_n = \frac{n}{2} \left[ 2a + (n-1) d \right] \]

\[ a = 9 \]

\[ d = a_2 - a_1 \]

\[ = 17 - 9 = 8 \]

\[ S_n = \frac{n}{2} \left[ 2a + (n-1) d \right] \]
\[
636 = \frac{n}{2} \left[ 2 \times 9 + (n-1) \times 8 \right] \\
1272 = n \left[ 18 + 8n - 8 \right] \\
1272 = n \left[ 10 + 8n \right] \\
8n^2 + 10n - 1272 = 0 \\
4n^2 + 5n - 636 = 0
\]

\[
n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\
n = \frac{-5 \pm \sqrt{5^2 - 4 \times 4 \times (-636)}}{2 \times 4} \\
n = \frac{-5 \pm 101}{8} \\
n = \frac{96}{8}, \quad n = \frac{-106}{8}, \quad n = \frac{-53}{4}
\]

\[n = 12 \text{ (since } n \text{ cannot be negative)}\]

27

Let \(\sqrt{3}\) be a rational number. Then \(\sqrt{3} = \frac{p}{q} \quad \text{HCF (p,q) = 1}\)

Squaring both sides
\[
(\sqrt{3})^2 = (\frac{p}{q})^2 \\
3 = \frac{p^2}{q^2} \\
3q^2 = p^2
\]

3 divides \(p^2 \Rightarrow 3\) divides \(p\)

3 is a factor of \(p\)

Take \(p = 3C\)
\[
3q^2 = (3c)^2 \\
3q^2 = 9C^2
\]

3 divides \(q^2 \Rightarrow 3\) divides \(q\)

3 is a factor of \(q\)

Therefore 3 is a common factor of \(p\) and \(q\)

It is a contradiction to our assumption that \(p/q\) is rational.

Hence \(\sqrt{3}\) is an irrational number.

28
Required to prove \( \angle PTQ = 2 \angle OPQ \)

**Sol:**

Let \( \angle PTQ = \theta \)

Now by the theorem TP = TQ. So, TPQ is an isosceles triangle

\( \angle TPQ = \angle TQP = \frac{1}{2} (180^\circ - \theta) \)

\( \angle OPT = 90^\circ \)

\( \angle OPQ = \angle OPT - \angle TPQ = 90^\circ - (90^\circ - \frac{1}{2} \theta) = \frac{1}{2} \theta = \frac{1}{2} \angle PTQ \)

\( \angle PTQ = 2 \angle OPQ \)

---

29

Let Meena has received \( x \) no. of 50 re notes and \( y \) no. of 100 re notes. So,

\( 50x + 100y = 2000 \)

\( x + y = 25 \)

Multiply by 50

\( 50x + 100y = 2000 \)

\( 50x + 50y = 1250 \)

\( 50y = 750 \)

\( y = 15 \)

Putting value of \( y = 15 \) in equation (2)

\( x + 15 = 25 \)

\( x = 10 \)

Meena has received 10 pieces 50 re notes and 15 pieces of 100 re notes.

---

30

(i) 10, 11, 12...90 are two digit numbers. There are 81 numbers. So, probability of getting a two-digit number

\( = \frac{81}{90} = \frac{9}{10} \)

(ii) 1, 4, 9, 16, 25, 36, 49, 64, 81 are perfect squares. So, probability of getting a perfect square number.

\( = \frac{9}{90} = \frac{1}{10} \)

(iii) 5, 10, 15...90 are divisible by 5. There are 18 outcomes. So, probability of getting a number divisible by 5.

\( = \frac{18}{90} = \frac{1}{5} \)
### OR

(i) Probability of getting A king of red colour.

\[ P(\text{King of red colour}) = \frac{2}{52} = \frac{1}{26} \]

(ii) Probability of getting A spade

\[ P(\text{a spade}) = \frac{13}{52} = \frac{1}{4} \]

(iii) Probability of getting The queen of diamonds

\[ P(\text{a the queen of diamonds}) = \frac{1}{52} \]

| 31 | \( r_1 = 6\text{cm} \)  
|    | \( r_2 = 8\text{cm} \)  
|    | \( r_3 = 10\text{cm} \)  
|    | Volume of sphere = \( \frac{4}{3} \pi r^3 \) 
|    | Volume of the resulting sphere = Sum of the volumes of the smaller spheres. 
|    | \[ \frac{4}{3} \pi r^3 = \frac{4}{3} \pi r_1^3 + \frac{4}{3} \pi r_2^3 + \frac{4}{3} \pi r_3^3 \] 
|    | \[ \frac{4}{3} \pi r^3 = \frac{4}{3} \pi (r_1^3 + r_2^3 + r_3^3) \] 
|    | \[ r^3 = 6^3 + 8^3 + 10^3 \] 
|    | \[ r^3 = 1728 \] 
|    | \[ r = 12\text{cm} \] 
|    | Therefore, the radius of the resulting sphere is 12cm.

| 32 | \( (\sin A - \cos A + 1)/ (\sin A + \cos A - 1) = 1/(\sec A - \tan A) \) 
|    | L.H.S. divide numerator and denominator by \( \cos A \) 
|    | \[ = (\tan A - 1 + \sec A)/ (\tan A + 1 - \sec A) \] 
|    | \[ = (\tan A - 1 + \sec A)/ (1 - \sec A + \tan A) \] 
|    | We know that \( 1 + \tan^2 A = \sec^2 A \) 
|    | Or \( 1 = \sec^2 A - \tan^2 A \) 
|    | \( 1 = (\sec A + \tan A)(\sec A - \tan A) \) 
|    | \[ = (\sec A + \tan A - 1)/[(\sec A + \tan A)(\sec A - \tan A) - (\sec A - \tan A)] \] 
|    | \[ = (\sec A + \tan A - 1)/(\sec A - \tan A)(\sec A + \tan A - 1) \]
Given:

Speed of boat =18 km/hr
Distance =24 km

Let \( x \) be the speed of stream.
Let \( t_1 \) and \( t_2 \) be the time for upstream and downstream.
As we know that,

\[
\text{speed} = \frac{\text{distance}}{\text{time}}
\]

\[
\Rightarrow \text{time} = \frac{\text{distance}}{\text{speed}}
\]

For upstream,
\[
\text{Speed} = (18-x) \text{ km/hr}
\]
\[
\text{Distance} = 24 \text{ km}
\]
\[
\text{Time} = t_1
\]
Therefore,
\[
t_1 = \frac{24}{18-x}
\]

For downstream,
\[
\text{Speed} = (18+x) \text{ km/hr}
\]
\[
\text{Distance} = 24 \text{ km}
\]
\[
\text{Time} = t_2
\]
Therefore,
\[
t_2 = \frac{24}{18+x}
\]

Now according to the question,

\[
t_1 = t_2 + 1
\]

\[
\frac{24}{18-x} = \frac{24}{18+x} + 1
\]

\[
\Rightarrow \frac{24(18+x) - 24(18-x)}{(18-x)(18+x)} = 1
\]

\[
\Rightarrow 48x = (18-x)(18+x)
\]

\[
\Rightarrow 48x = 324 + 18x - 18x - x^2
\]

\[
\Rightarrow x^2 + 48x - 324 = 0
\]

\[
\Rightarrow x^2 + 54x - 6x - 324 = 0
\]

\[
\Rightarrow (x+54)(x-6) = 0
\]
\[ x = -54 \text{ or } x = 6 \]

Since speed cannot be negative.

\[ x = -54 \text{ will be rejected} \]

\[ x = 6 \]

Thus, the speed of stream is 6 km/hr.

**OR**

Let one of the odd positive integer be \( x \)
then the other odd positive integer is \( x + 2 \)
their sum of squares = \( x^2 + (x+2)^2 \)
\[ = x^2 + x^2 + 4x + 4 \]
\[ = 2x^2 + 4x + 4 \]

Given that their sum of squares = 290
\[ \Rightarrow 2x^2 + 4x + 4 = 290 \]
\[ \Rightarrow 2x^2 + 4x = 290 - 4 = 286 \]
\[ \Rightarrow 2x^2 + 4x - 286 = 0 \]
\[ \Rightarrow 2(x^2 + 2x - 143) = 0 \]
\[ \Rightarrow x^2 + 13x - 11x - 143 = 0 \]
\[ \Rightarrow x(x + 13) - 11(x + 13) = 0 \]
\[ \Rightarrow (x - 11)(x + 13) = 0 \]
\[ \Rightarrow (x - 11) = 0 \text{, } (x + 13) = 0 \]
Therefore, \( x = 11 \) or -13

According to question, \( x \) is a positive odd integer.
Hence, We take positive value of \( x \)

So, \( x = 11 \) and \( (x + 2) = 11 + 2 = 13 \)
Therefore, the odd positive integers are 11 and 13.
Let AB and CD be the multi-storeyed building and the building respectively.

Let the height of the multi-storeyed building = \( h \) m and the distance between the two buildings = \( x \) m.

\( AE = CD = 8 \) m [Given]

\( BE = AB - AE = (h - 8) \) m

and

\( AC = DE = x \) m [Given]

Also,

\( \angle FBD = \angle BDE = 30^\circ \) (Alternate angles)

\( \angle FBC = \angle BCA = 45^\circ \) (Alternate angles)

Now,

In \( \Delta ACB, \)

\[ \Rightarrow \tan 45^\circ = \frac{AB}{AC} \quad [\because \tan \theta = \frac{\text{Perpendicular}}{\text{Base}}] \]

\[ \Rightarrow 1 = \frac{h}{x} \]

\[ \Rightarrow x = \frac{h}{1} \quad \text{(i)} \]

In \( \Delta BDE, \)
From (i) and (ii), we get,

\[ h = \sqrt{3}h - 8\sqrt{3} \]

\[ \sqrt{3}h - h = 8\sqrt{3} \]

\[ h (\sqrt{3} - 1) = 8\sqrt{3} \]

\[ h = \frac{8\sqrt{3}}{\sqrt{3} - 1} \]

\[ h = \frac{8\sqrt{3}}{\sqrt{3} - 1} \cdot \frac{\sqrt{3} + 1}{\sqrt{3} + 1} \]

\[ h = 4\sqrt{3} (\sqrt{3} + 1) \]

\[ h = 12 + 4\sqrt{3} \text{ m} \]

Distance between the two building

\[ x = (12 + 4\sqrt{3}) \text{ m} \quad [\text{From (i)}] \]

\[ x = 4\sqrt{3} (\sqrt{3} + 1) \]

\[ x = 12 + 4\sqrt{3} \text{ m} \]

**OR**

From the figure, the angle of elevation for the first position of the balloon \( \angle EAD = 60^\circ \) and for second position \( \angle BAC = 30^\circ \). The vertical distance

\[ ED = CB = 88.2 - 1.2 = 87 \text{ m} \]
Let AD = x m and AB = y m.

Then in right Δ ADE, \( \tan 60^\circ = \frac{DE}{AD} \)

\[ \sqrt{3} = \frac{87}{x} \]

\[ x = \frac{87}{\sqrt{3}} \quad \ldots \ldots \text{(i)} \]

In right ΔABC, \( \tan 30^\circ = \frac{BC}{AB} \)

\[ \frac{1}{\sqrt{3}} = \frac{87}{y} \]

\[ y = 87\sqrt{3} \quad \ldots \ldots \text{(ii)} \]

Subtracting (i) and (ii)

\[ y - x = 87\sqrt{3} - \frac{87}{\sqrt{3}} \]

\[ y - x = 58\sqrt{3} \text{ m} \]

Hence, the distance travelled by the balloon is equal to BD

\[ y - x = 58\sqrt{3} \text{ m} \]

Let A be the first term and D the common difference of A.P.

\[ T_p = a = A + (p - 1)D = (A - D) + pD \quad \text{(1)} \]

\[ T_q = b = A + (q - 1)D = (A - D) + qD \quad \ldots \ldots \text{(2)} \]

\[ T_r = c = A + (r - 1)D = (A - D) + rD \quad \ldots \ldots \text{(3)} \]

Here we have got two unknowns A and D which are to be eliminated.

We multiply (1), (2) and (3) by \( q - r, r - p \) and \( p - q \) respectively and add:

\[ a(q - r) = (A - D)(q - r) + D(p(q - r)) \]

\[ b(r - p) = (A - D)(r - p) + D(q(r - p)) \]

\[ c(p - q) = (A - D)(p - q) + D(r(p - q)) \]

\[ a(q - r) + b(r - p) + c(p - q) \]

\[ = (A - D)[q - r + r - p + p - q] + D[p(q - r) + q(r - p) + r(p - q)] \]

\[ = (A - D)(0) + D[pq - pr + qr - pq + rp - rq] \]

\[ = 0 \]
Height (in cm) | f | C.F.
---|---|---
below 140 | 4 | 4
140-145 | 7 | 11
145-150 | 18 | 29
150-155 | 11 | 40
155-160 | 6 | 46
160-165 | 5 | 51

\(N=51\Rightarrow\)

\(N/2=51/2=25.5\)

As 29 is just greater than 25.5, therefore median class is 145-150.

\[\text{Median} = l + \left(\frac{\frac{N}{2} - C}{f}\right) \times h\]

Here, \(l\) = lower limit of median class =145

\(C\) = C.F. of the class preceding the median class =11

\(h\) = higher limit - lower limit =150−145=5

\(f\) = frequency of median class =18

\[\therefore \text{median} = 145 + \left(\frac{25.5−11}{18}\right) \times 5\]

\(=149.03\)

Mean by direct method

\[
\text{Mean} = \frac{\sum fx}{N}
\]

\[=7637.5/51\]

\[=149.75\]