WITH GRAPH PAPER

Subject: MATHEMATICS

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Person with Disabilities: No

If physically challenged, tick the category:

B = Blind, D = Deaf, H = Hearing, S = Spastic, C = Cerebral Palsy

Whether writer provided: No

If visually challenged, name of software used:

Each letter to be written in one box and one box to be left blank between each part of the name. In case Candidate's Name exceeds 24 letters, write first 24 letters.

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Section A

1. A = getting a rotten apple.
   \[ n(s) = 900 \quad \text{total apples} \]
   \[ P(A) = 0.18 \]
   Let \( n(A) \) be the number of rotten apples.
   Then,
   \[ P(A) = \frac{n(A)}{n(s)} = \frac{n(A)}{900} \]
   \[ 0.18 \times 900 = n(A) \]
   \[ \therefore n(A) = 162 \]
   So, there are 162 rotten apples in the heap.

2. Tower AB is 30m and shadow BC is 10√3m.
   In \( \triangle ABC \) which is right triangle,
   \[ \tan \theta = \frac{AB}{BC} = \frac{30}{10\sqrt{3}} \]
   \[ \tan \theta = \sqrt{3} \]
   \[ \text{but } \tan 60^\circ = \sqrt{3} \quad \therefore \theta = 60^\circ \]
   So, angle of elevation of sun is 60°.
3. Tangents are equally inclined to the line joining the external point P to centre O.

\[ \angle APO = \angle BPO = \frac{60}{2} = 30^\circ \]

Also, radius 1 tangent at point of contact.

In right \( \triangle APB \), \( \angle APO = 30^\circ \).

Now \( \sin 30^\circ = \frac{AB}{OP} \)

\[ \frac{1}{2} = \frac{a}{OP} \]

\( \therefore \) radius = \( a \).

\[ OP = 2a \]

4. Let \( a \) be \( 1st \) term and \( d \) be the common difference.

\[ a_{21} - a_7 = 84 \]

\[ a + (21-1)d - (a + (7-1)d) = 84 \]

\[ a + 20d - a - 6d = 84 \]

\[ 14d = 84 \]

\[ d = 6 \]

\( \therefore \) common difference is 6.
Section D

21. The points A, B and C are collinear.
   \[ A(\Delta ABC) = 0. \]
   Using area formula,
   \[ x_1 = k+1, \quad x_2 = 3k, \quad x_3 = 5k-1 \]
   \[ y_1 = 2k, \quad y_2 = 2k+3, \quad y_3 = 5k. \]
   Using area formula,
   \[ x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2) = 0. \]
   \[ (k+1)(2k+3-5k) + 3k(5k-2k) + (5k-1)(2k-2k-3) = 0 \]
   \[ (k+1)(3-3k) + 3k(3k) + (5k-1)(-3) = 0. \]
   \[ 3(1+k)(1-k) + 3(k)(9k) - 3(5k-1) = 0. \]
   \[ 3 \left[ 1-k^2 + 8k^2 - 5k+1 \right] = 0. \]
   \[ 2k^2 - 5k+2 = 0 \]
   \[ 2k^2 - 2k - k+2 = 0 \]
   \[ 2k(k-2) -1(k-2) = 0 \]
\[(2k-1) (k-2) = 0\]
\[
\therefore (k-2) = 0 \quad \text{or} \quad (2k-1) = 0
\]
\[\therefore k = 2 \quad \text{or} \quad \frac{1}{2}\]

22. In \(\triangle ABC\),
\[\angle A + \angle B + \angle C = 180^\circ \quad - \text{angle sum property.}\]

\[
105^\circ + 45^\circ + \angle C = 180^\circ
\]
\[\therefore \angle C = 30^\circ\]

Steps of construction:
1) Draw \(BC = 7\) cm \(\angle BY = 45^\circ\) and \(\angle B C Z = 30^\circ\).
2) From \(B\) draw a ray \(BX\) below \(BC\) making acute angle with \(BC\). Along it mark 4 points \(B_1, B_2, B_3, B_4\) such that \(BB_1 = B_1B_2 = \ldots = B_3B_4\).
3) Join \(B_4 C\). Make \(\angle BB_4 C = \angle B B_4 C\). The ray intersects \(BC\) at \(C'\).
4) From \(C'\) make \(\angle B C' A_1 = BCA\) so that \(C'A_1 \parallel CA\).

\(\triangle A'B'C'\) is the required triangle.
Justification: \( \angle B = \angle B \), and \( \angle B C_1 A_1 = \angle B C A \) - construction

\[ \triangle A'B'C' \sim \triangle ABC \] by \( \text{SSA} \)

so, \( \frac{A'B}{AB} = \frac{A'C}{AC} = \frac{BC}{BC} = \frac{3}{4} \)

\( \triangle A'B'C' \) is required triangle.
23.
i) \( A = \text{sum of digits is even.} \)

\[
n(s) = 6^2 = 36, \quad \text{total possible outcomes.}
\]

\[
n(A) = \{ (1,3), (1,5), (1,1), (2,2), (2,4), (2,6, (3,1), (3,3), (3,5), \]
\[ (4,2), (4,4), (4,6), (5,1), (5,3), (5,5), (6,2), (6,4), (6,6) \}
\]

\[
= 18
\]

\[
P(A) = \frac{n(A)}{n(s)} = \frac{18}{36} = \frac{1}{2} \quad \text{or} \quad 0.5
\]

\[ . \quad \text{probability of getting an even sum is} \quad \frac{1}{2} \quad \text{or} \quad 0.5. \]


ii) \( A = \text{product of digits is even} \)

\[
n(s) = 36.
\]

\[
n(A) = \{ (1,2), (1,4), (1,6), (2,1), (2,2), (2,3), (2,4), (2,5), (2,6), \]
\[ (3,2), (3,4), (3,6), (4,1), (4,2), (4,3), (4,4), (4,5), (4,6), \]
\[ (5,2), (5,4), (5,6), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6) \}
\]

\[
= 27
\]
\[ P(A) = \frac{n(A)}{n(S)} = \frac{27}{36} = 0.75 \]

The probability of getting an even product is \( \frac{3}{4} \) or 0.75.

Given: \( XY \parallel X'Y' \) - tangents.
\( POQ \) is diameter, \( OC \) is radius.
Tangent \( ACB \) touches \( XY \) at \( A \) and \( X'Y' \) at \( B \).

To prove: \( \angle AOB = 90^\circ \).

Proof: \( XY \parallel X'Y' \) and \( AB \) is transversal
\[ \angle XAB + \angle ABX' = 180^\circ \] - co-interior angles.
or \[ \angle PAB = \angle OAB \]

It is known that tangents from a same point are equally inclined to the line joining centre to that point.
\[ \Rightarrow \angle PAB = \angle CAO \quad \text{and} \quad \angle QBO = \angle CBD \]
In (1),
- \(2 \angle CAD + 2 \angle CDB = 180^\circ\)

or \(2 \angle BAO + 2 \angle AB = 180^\circ\)
- \(\angle BAO + \angle LAB = 90^\circ\) \(-2\)

In \(\triangle AOB\),
- \(\angle BAO + \angle LAB + \angle AOB = 180^\circ\) - anglesum.

From(2), \(90^\circ + \angle AOB = 180^\circ\)
- \(\angle AOB = 90^\circ\)

Hence, proved.

As radius of cylindrical tank = \(\frac{2}{2} = 1\) m.

its height = \(3.5 \text{ m} = \frac{35}{2} \text{ m}\)

let the height of water on roof be \(h\).

volume of water on roof = volume of water in tank.

\[ \ell \text{bh} = \pi r^2 h \]

\[ 22 \times 20 \times h = \frac{22}{2} \times \frac{35}{2} \times \frac{22}{2} \times \frac{1}{1} \]

\[ h = \frac{22 \times \frac{1}{2} \times \frac{1}{2}}{22 \times \frac{22}{2} \times \frac{1}{20}} = \frac{1}{40} \text{ m} \]
\[
\frac{h}{40} = \frac{1 \times 100}{40} \text{ cm}
\]

\[
= 2.5 \text{ cm}
\]

So, the rainfall is 2.5 cm.

Views on water conservation:

a) It is important practice in today's era of irrational water consumption and pollution. It should be practised at municipal level at all places.

b) It can be done by many simple ways even at domestic level.

c) Doing it is a sign of environmental consciousness.

d) Some methods of water conservation are rooftop/surface water harvesting, building small earthen dams, etc.

e) This conserved water helps refill underground water bodies and so, all must practise water conservation for sustainable development.
Given: Circle \( \odot C(0, r) \)

- 2 tangents from \( P \) at \( A \) and \( B \)

To prove: \( AP = BP \)

Construction: Join \( OA, OB \) and \( OP \)

Proof:

In \( \triangle APO \) and \( \triangle BPO \),

- \( OA = OB \) — radii of same circle.
- \( OP = OP \) — common side.
- \( \angle OAP = \angle OBP = 90^\circ \) — radius is \( 1 \) tangent at point of contact,

by RHS criterion,

\( \triangle APO \cong \triangle BPO \).

and hence, \( AP = BP \) — by cpct.

- Lengths of 2 tangents drawn from an external point to a circle are equal.

Q7. Let \( a, d \) and \( A, d \) be the 1st term and common difference of the 2 APs respectively.
Then,

$$\frac{n}{2} \left[ 2a + (n-1)d \right] = \frac{7n+1}{4n+27}$$

$$\frac{n}{2} \left[ 2A + (n-1)d \right]$$

$$\frac{2a + (n-1)d}{2A + (n-1)d} = \frac{7n+1}{4n+27}$$

Replacing \( n \) by 17 in both LHS and RHS,

$$\frac{2a + (17-1)d}{2A + (17-1)d} = \frac{7(17)+1}{4(17)+27}$$

$$\frac{2a+16d}{2A+16d} = \frac{119+1}{68+27}$$

$$\frac{\phi(a+8d)}{\phi(a+8d)} = \frac{120}{95}$$

as \( a + (n-1)d = a_n \),

$$a_9 = 24$$

$$A_9 = 19$$

:. ratio of 9th terms is 24:19
28. Let $\frac{x-1}{2a+1}$ be $y$,

\[
\frac{y + 1}{y} = 2
\]

\[y^2 + 1 = 2y\]
\[y^2 - 2y + 1 = 0\]
\[y^2 - y - y + 1 = 0\]
\[y(y-1) - 1(y-1) = 0\]
\[y(y-1)(y-1) = 0\]
\[y = 1 \text{ or } 1.
\]

Now, \(\frac{x-1}{2a+1} = 1\) or \(\frac{x-1}{2a+1} = 1\)

\[x - 1 = 2a + 1\]
\[-2 = x\]
\[\therefore \ x = -2 \text{ or } -2\]

\[\therefore \ x = -2\]
29. Let B complete a work in $x$ days.

Then A takes $x-6$ days to complete it.

Together they complete it in 4 days.

According to work done per day,

\[ \frac{1}{x-6} + \frac{1}{x} = \frac{1}{4} \]

\[ \frac{x + x - 6}{x(x - 6)} = \frac{1}{4} \]

\[ 4(2x - 6) = x(x - 6) \]

\[ 8x - 24 = x^2 - 6x \]

\[ x^2 - 14x + 24 = 0 \]

\[ x^2 - 12x - 2x + 24 = 0 \]

\[ x(x - 12) - 2(x - 12) = 0 \]

\[ (x - 2)(x - 12) = 0 \]

\[ x = 2 \text{ or } 12. \]

But $x = 2$ is not possible because then $x - 6$ is < 4.

\[ x = 12. \]

So, B takes 12 days to finish the work.
To Find: AC

Solution:

In $\triangle ABD$, $\angle DAB = 30^\circ$

In $\triangle BDC$, $\angle BCD = 45^\circ$

Also, $BD = 100 \text{ m}$.

In right $\triangle ABD$,

\[ \tan 30^\circ = \frac{DB}{AB} \]

\[ \frac{1}{\sqrt{3}} = \frac{100}{AB} \]

\[ AB = 100\sqrt{3} \approx 100 \times 1.732 \]

\[ = 173.2 \text{ m} \]

In right $\triangle DBC$,

\[ \tan 45^\circ = \frac{DB}{BC} \]

\[ 1 = \frac{100}{BC} \]

\[ BC = 100 \text{ m} \]

Now, $AC = AB + BC = 100 + 173.2 \text{ m} = 273.2 \text{ m}$

or $100(\sqrt{3} + 1.732) \text{ m}$
\[ \angle CAB = 90^\circ \] angle subtended by diameter.

In right \( \Delta CAB \),

by Pythagoras theorem,
\[ AC^2 + AB^2 = BC^2 \]
\[ \begin{align*}
24^2 + 7^2 &= BC^2 \\
576 + 49 &= BC^2 \\
625 &= BC^2 \\
\text{ignoring -ve value}
\end{align*} \]

\[ BC = 25 \text{ cm, diameter}. \]

\[ \text{radius} = 12.5 \text{ cm or } 2.5 \text{ cm}. \]

The area of shaded region = area of semicircle + area of quadrant - area of \( \Delta ABC \)
\[ = \frac{3}{2} \times \pi r^2 + \frac{1}{4} \times \pi r^2 - \frac{1}{2} \times AB \times AC \]
\[ = \frac{3}{4} \pi r^2 - \frac{1}{2} \times 7 \times 24 \]
\[ = \frac{3}{4} \times 62 \times 625 - 7 \times 12 \]
\[ = 368.3035 - 8.4 \]
The area of shaded region is \( \approx 284.3 \text{ cm}^2 \)

\[ \approx 284.3 \text{ cm}^2 \]
Section C

It is given that $\angle ACB$ and $\angle ADB$ are complementary.

Let them be $\theta$ and $90 - \theta$ respectively.

Now,

In right $\triangle ABC$,

$$\tan \theta = \frac{AB}{BC} = \frac{h}{4}$$

$$\tan \theta = \frac{h}{4} \tag{1}$$

In right $\triangle ABD$,

$$\tan(90 - \theta) = \frac{AB}{BD} = \frac{h}{16}$$

$$\cot \theta = \frac{h}{16} \tag{2}$$

$$\cot \theta = \frac{1}{\tan \theta}$$
From (1) and (2),

\[ \tan \theta = \frac{h}{4} = 16 \]
\[ h = 4 \times 16 \]
\[ h = 8 \text{ m} \] (ignoring negative value).

\[ \therefore \text{height of tower is } 8 \text{ m}. \]

12. Let there be \( x \) black balls and 15 white balls.

Total balls = \( n(S) = 15 + x \)

\[ P(\text{drawing black ball}) = \frac{3 \times P(\text{drawing white ball})}{(15 + x)} \]

\[ = \frac{3 \times 15}{(15 + x)} \times \frac{15}{(15 + x)} \]

\[ = \frac{15}{15 + x} \]

\[ \therefore x = 45 \]

\[ \therefore \text{There are } 45 \text{ black balls in the bag}. \]
13. Area of shaded region = Area of semicircle with \(d = 4.5\) cm

\[ \frac{1}{2} \pi \times (4.5)^2 + \left( \frac{1}{2} \pi \times (3)^2 \right) - 2 \times \left( \frac{1}{2} \pi \times (3)^2 \right) - 2 \pi \times \left( \frac{4.5}{2} \right)^2 \]

\[ = \left( \frac{-2 \pi \times (4.5)^2}{2} \right) \]

\[ = 2 \times \left( \frac{1}{2} \pi \times 20.25 \right) - \frac{\pi}{2} \times 9 - \frac{\pi}{2} \times 20.25 \]

\[ = \frac{\pi}{4} \left[ 2 \times 20.25 - \frac{9}{2} - 20.25 \right] \]

\[ = \frac{\pi}{4} \left[ 40.5 - 4.5 - 20.25 \right] \]

\[ = \frac{\pi}{4} \left( 15.75 \right) \]
\[ \frac{22.5}{2} \times 2.25 = \frac{24.75}{2} = 12.375 \text{ cm}^2 \]

The area of the shaded region is 12.375 cm².

14. Using section formula, \( P \left( x_1, y_1 \right) \) and \( Q \left( x_2, y_2 \right) \) are given.

Here \( x_1 = 2, y_1 = -2 \)

\( x_2 = 8, y_2 = 7 \)

\[ \left( x, y \right) = \left( \frac{3m + 2n}{m + n}, \frac{-7m - 2n}{m + n} \right) \]

\[ \Rightarrow 24 = \frac{3m + 2n}{11} \]

\[ 24n + 24n = 33m + 22n \]
\[
2n = 9m \\
\frac{2}{9} = \frac{m}{n}
\]

\[\therefore \text{ The given point divides the line segment in ratio } 2:9.\]

Taking \(m = 2\) and \(n = 9\),

\[
y = \frac{7m - 2n}{m + n}
\]

\[
y = \frac{7(2) - 2(9)}{2 + 9}
\]

\[
y = \frac{14 - 18}{11}
\]

\[
y = -\frac{4}{11}
\]

15. Speed of water in canal = 25 km/hr.

In 40 min = \(\frac{40}{60} = \frac{2}{3}\) hr,

Length of water = \(25 \times \frac{2}{3} = \frac{50}{3}\) km = \(50000\) m
volume of water in canal in 40 minutes = volume of water for irrigation.

\[
\frac{18}{10} \times \frac{50,000}{10} m^3 = \frac{10}{100} \times 2 \times b m^3
\]

\[
324 \times 5000 = 2 \times b
\]

\[
1600 1620000 = 2 \times b
\]

Area irrigated in 40 minutes is

\[
1620000 m^2 = \frac{1620000}{1000000} = 1.62 \text{ km}^2 \text{ or } 162 \text{ hectares.}
\]

16. \[\angle AOB = \angle COD = 60^\circ \quad R = 42 cm, r = 21 cm.\]

Reflex of \[\angle AOB = 300^\circ = \theta (360^\circ - 60^\circ)\]

Now, area of shaded region

\[
= \frac{\theta}{360^\circ} \times \pi r^2 - \frac{\theta}{360^\circ} \times \pi R^2
\]
\[
\frac{\theta}{360^\circ} \times \pi \times (R^2 - r^2)
\]
\[
= \frac{300^\circ}{360^\circ} \times \pi \times (42 - 21)(42 + 21)
\]
\[
= \frac{5}{6} \times \frac{22}{7} \times 21 \times 63
\]
\[
= 5 \times 11 \times 63
\]
\[
= 346.5 \text{ cm}^2
\]

Area of shaded region is 3.465 cm\(^2\) or 0.3465 m\(^2\)

17. For the hollow cylindrical pipe, 
\(r = 30 \text{ cm}\) and \(R = 30 + 5 = 35 \text{ cm}\).
Let its length be \(h\).
Volume of the \(2\) is same.
\[
\frac{4}{3} \times \pi \times r^2 \times h = \frac{4}{3} \times \pi \times 100 \times 26 \times 100 \times 100 = \pi h (R^2 - r^2)
\]
\[
440 \times 260 \times 100 = 22 \times h \times (35 + 30)(35 - 30)
\]
\[
\begin{align*}
440 \times 260 \times 100 &= \frac{22 \times h \times 65 \times 5}{7} \\
\Rightarrow \quad \frac{20}{7} \times \frac{4}{22} \times \frac{20}{65} &= h \\
7 \times 20 \times 4 \times 20 &= h \\
11200 &= h \\
\text{pipe is 11200 cm or 112 m long} \\
\text{Height of hemisphere} &= r \\
&= 3.5 \text{ cm} \\
\text{Height of cone} &= 15.5 \text{ cm} - 3.5 \text{ cm} \\
&= 12 \text{ cm} = h \\
\text{Slant height of cone} &= \sqrt{r^2 + h^2} \\
&= \sqrt{12.25 + 14.4} \\
&= \sqrt{156.25} \\
&= 12.5 \text{ cm}
\end{align*}
\]
TSA of toy = CSA of cone + CSA of hemisphere

\[ \text{TSA of toy} = T \pi r l + 2 \pi r^2 \]

\[ \frac{\pi}{7} \cdot 22 \times 12.5 \times 3.5 + 2 \times 22 \times 8.5 \times 3.5 \]

\[ = 22 \times 12.5 \times 0.5 + 22 \times 8.5 \]

\[ = 22 \left( \frac{12.5 \times 5}{10} + 3.5 \right) \]

\[ = 22 \left( 12.5 \times \frac{1}{2} + 3.5 \right) \]

\[ = 22 \left( 6.25 + 3.5 \right) \]

\[ = 22 \times 9.75 \]

\[ = 214.5 \text{ cm}^2 \]

Total surface area of toy is 214.5 cm²
19. \( a = 9, \ d = 8, \ \text{Sn} = 636. \)

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

\[
636 = \frac{n}{2} \left[ 18 + (n-1)8 \right]
\]

\[
636 = n \left( 9 + (n-1)4 \right)
\]

\[
636 = n \left( 9 + 4n - 4 \right)
\]

\[
636 = n \left( 5 + 4n \right)
\]

\[
636 = 5n + 4n^2
\]

\[
4n^2 + 5n - 636 = 0
\]

\[
4n^2 + 53n - 48n - 636 = 0
\]

\[
m \in 4n+5
\]

\[
n^2 - 48n + 53n = 636 = 0
\]

\[
n(n - 12) + 53(n - 12) = 0
\]

\[
(4n+53)(n-12) = 0
\]

\[
\therefore n = -\frac{53}{4} \text{ or } 12.
\]

As \( n \) is a natural number, \( n = 12 \)

\[
\therefore 12 \text{ terms are required to give sum 636.}
\]
20. \[ A = (a^2 + b^2), \quad B = -2(ac + bd), \quad C = (c^2 + d^2) \]

as roots are equal,

\[ D = B^2 - 4AC = 0. \]

\[ B^2 = 4AC \]

\[ (-2(ac + bd))^2 = 4(a^2 + b^2)(c^2 + d^2) \]

\[ 4(a^2c^2 + 2abcd + b^2d^2) = 4(a^2c^2 + a^2d^2 + b^2c^2 + b^2d^2) \]

\[ 2abcd = a^2d^2 + b^2c^2 \]

\[ 0 = a^2d^2 - 2abcd + b^2c^2 \]

\[ 0 = (ad - bc)^2 \]

\[ 0 = ad - bc \]

\[ ad = bc \]

\[ \begin{align*}
  a &= \frac{c}{b} \\
  b &= \frac{a}{d}
\end{align*} \]

Hence, proved.
Section B


To prove: $AB + CD = AD + BC$.

Proof:

$AP = AS$

$PB = BO$

$DR = DS$

$CR = CO$

Tangents from same point to a circle are equal in length.

Adding $AD$, $AB + PB + OR + CR = AS + BO + DS + CO$.

$AB + CD = AS + SD + BO + QC$

Hence, proved.
Given: chord AB.

Tangents AP and BP at A&B

To prove: \( AP = BP \) \( \angle PAM = \angle PBM \)

Construction: Join centre O to P

Let OP meet AB at M.

Proof:

In \( \triangle AMP \) and \( \triangle BMP \),

\( AP = BP \) — tangents from same point
to a circle are equal.

\( MP = MP \) — common side

\( \angle PAM = \angle BPM \) — tangents are equally inclined
to line joining the point
to circle's centre. \( \therefore \) congruence

by SAS criterion,

\( \triangle AMP \cong \triangle BMP \)

by c.p.c.t., \( \angle PAM = \angle PBM \)

Hence, tangents at endpoints of a chord
make equal angles with it.
7. Let coordinates of P be \((0, y)\) and of Q be \((x, 0)\).

\((2, -5)\) is mid-point of PQ.

By section formula,

\[
\left( \frac{0+x}{2}, \frac{y+0}{2} \right) = (2, -5)
\]

\[
2 = \frac{x}{2} \quad \text{and} \quad -5 = \frac{y}{2}
\]

\[
x = 4 \quad \text{and} \quad y = -10.
\]

P is \((0, -10)\) and Q is \((4, 0)\).

8. \(PA = PB\)

\[PA^2 = PB^2\]

By distance formula,

\[
(5-x)^2 + (1-y)^2 = (-1-x)^2 + (5-y)^2
\]

\[
\Rightarrow (5-x)^2 + (1-y)^2 = (1+x)^2 + (5-y)^2
\]

\[
25 - 10x + x^2 + 1 - 2y + y^2 = 1 + 2x + x^2 + 25 - 10y + y^2
\]

\[
-10x - 2y = 2x - 10y
\]
8y = 12x

4r(2y) = 4r(3x)

3x = 2y

Hence, proved.

9. Let \( \alpha \) and \( \beta \) be the roots of given quadratic equation.

\[
\beta = 6\alpha
\]

Here, \( a = p \), \( b = -14 \), \( c = 8 \).

\[
\alpha + \beta = \frac{-(14)}{p} = \frac{-b}{a}
\]

\[
\frac{8\alpha}{p} = \frac{+42}{p}
\]

\[
\alpha = \frac{2}{p}
\]

Also, \( \alpha \beta = \frac{8}{p} = \frac{c}{a} \)

\[
\alpha \times 6\alpha = \frac{8}{p}
\]
\[ 6x^2 = \frac{8}{p} \]

From (1),
\[ 6 \left( \frac{2}{p} \right)^2 = \frac{8}{p} \]
\[ 6 \times \frac{4}{p^2} = \frac{8}{p} \]
\[ \frac{6}{p^2} = \frac{2}{p} \]
\[ \frac{6}{2} = \frac{p^2}{p} \]
\[ \therefore p = 3 \]

10. Let \(a, d\) and \(A, D\) be the 1st term and common difference of the 2 A.Ps respectively.

\(m\) is same.
\(a = 63, \quad d = 2\)
\(A = 3, \quad d = 7\)
\[ a_n = A_n \]

\[ \Rightarrow a + (n-1)d = A + (n-1)D \]

\[ 63 + (n-1)2 = 2 + (n-1)7 \]

\[ 63 + 2n - 2 = 2 + 7n - 7 \]

\[ 61 + 2n = 7n - 4 \]

\[ 65 = 5n \]

\[ 13 = n \]

\[ \therefore \text{When } n \text{ is 13, the } n^{th} \text{ terms are equal} \]

\[ \text{\textit{i.e., } a_{13} = A_{13}.} \]