Sample Question Paper 02
Class -IX Mathematics
Summative Assessment – II

Time: 3 Hours **Max. Marks: 90**

General Instructions:

(i) All questions are compulsory.

(ii) The question paper consists of **31** question divided into five **section A, B, C, D and E**. Section-A comprises of **4** question of **1 mark** each, **Section-B** comprises of **6** question of **2 marks** each, **Section-C** comprises of **8** question of **3 marks** each and **Section-D** comprises of **10** questions of **4 marks** each. **Section E** comprises of **two questions of 3 marks each** and **1 question** of **4 marks from Open Text theme.**

(iii) There is no overall choice.

(iv) Use of calculator is not permitted.

SECTION-A

Question number **1** to **4** carry **one** mark each.

1. Find the ratio of surface area and volume of the sphere of unit radius.
2. In a frequency distribution, the mid-value of a class is 10 and the width of the class is 6. Find the lower limit of the class.
3. In tossing a coin 100 times head appears 56 times. What is the probability of head for the coin?
4. If two adjacent sides of a kite are 5cm and 7cm, find its perimeter.

SECTION-B

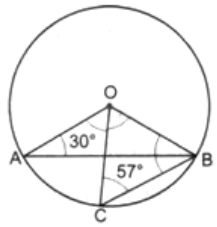
Question number **5** to **10** carry **two** marks each.

5. Write any two solution of the linear equation $3x + 2y = 9$.
6. Draw the graph of the equation represented by the straight line which is parallel to the x – axis and 3 units above it.
7. Prove that the line of centres of two intersecting circles subtends equal angles at the two points of intersection.
8. If L be any Point on AB and the area of rectangle ABCD is 100 square cm. Find area of ΔLCD.
9. Express x in terms of y for the linear equation $\frac{2}{3}x + 4y = -7$.
10. Mean of 50 observations was found to be 80.4 . But later on, it was discovered that 96 was misread as 69 at one place. Find the correct mean.

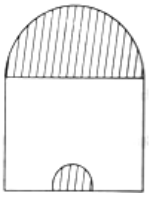
SECTION-C

Question numbers **11** to **18** carry **three** marks each.

11. Solve for x: (5x + 1)(x + 3) – 8 = 5(x + 1)(x + 2)
12. The cost of a toy horse is same as that of cost of 3 balls. Express this statement as a linear equation in two equation in two variables. Also draw its graph.
13. In given figure, $\angle OAB = 30°$ and $\angle OCB = 57°$. Find $\angle BOC$ and $\angle AOC$.



14. A cylinder and a cone have equal heights and equal radii of their bases. If their curved surface areas are in the ratio 8 : 5. Show that the ratio of radius to height of each is 3 : 4.
15. Two hemispherical domes are to be painted as shown in the given figure. If the circumferences of the bases of the domes are 17.6 cm and 70.4 cm respectively, then find the cost of painting at the rate of Rs10 per cm .



16. The capacity of a closed cylindrical vessel of height 1 m is 15.4 litres. How many square metres of metal sheet would be needed to make it?
17. A class consists of 50 students out of which 30 are girls. The mean marks scored by girls in a test is 73 (out of 100) and that of boys is 71. Determine the mean score of the whole class.
18. A recent survey found that the ages of workers in a factory are distributed as follows:

Age (in years)	20 – 29	30 – 39	40 –49	50 – 59	60 and above
Number of workers	38	27	86	46	3

If a person is selected at random, find the probability that the person is:
(i) 40 years or more.
(ii) under 40 years.
(iii) under 60 but over 39 years.

SECTION-D

Question numbers **19** to 28 carry **four** marks each.

19. Construct a triangle ABC in which BC = 8 cm, $\angle B = 45°$ and AB - AC= 3.5 cm.
20. Construct a triangle XYZ in which $\angle Y = 30°$, $\angle Z = 90°$ and XY + YZ + ZX = 11 cm.

21. If two circles intersect at two points, prove that their centres lie on the perpendicular bisector of the common chord.
22. Show that the diagonals of a parallelogram divide if into four triangles of equal area.
23. The ratio of girl and boys in a class is 1: 3. Set up an equation between the students of a class of 40 students from the graph.
24. The difference between outside and inside surface of a cylindrical metallic tripe 14 cm. long is 44 sq cm. if the tripe is made of 99 cu cm. of metal, find the outer and inner radius of the tripe.
25. The surface area of a sphere of radius 5 cm is five times the curved surface area of a cone of radius 4 cm. Find the height and volume of the cone.
26. Two solid spheres made of the same metal have masses 5920 g and 740 g, respectively. Determine the radius of the larger sphere, if the diameter of the smaller sphere is 5 cm.
27. Prove that the sum of the deviations of individuals observations from the mean is zero.
28. Cards marked 2 to 101 are placed in a box and mixed thoroughly. One card is drawn from the box. Find the probability that number on the card is (i) an even number (ii) a number less than 14 (iii) a number which is a perfect square (iv) a prime number less than 20. (v) an odd number.

SECTION-E (10 Marks)

(Open Text from Chapter-8 Quadrilaterals)

(*Please ensure that open text of the given theme is supplied with this question paper.)

29. OTBA Question
30. OTBA Question
31. OTBA Question

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Solution

SECTION-A

Question number **1** to **4** carry **one** mark each.

1. Required ratio $= \dfrac{4\pi r^2}{\frac{4}{3}\pi r^3} = \dfrac{3\times 4\times \pi \times (1)^2}{4\times \pi \times (1)^3} = \dfrac{3}{1}$ $(\because r = 1)$

   i.e., 3 : 1

2. Lower limit of the class $= 10 - \dfrac{1}{2}\times 6 = 10 - 3 = 7$

3. $\text{P (head)} = \dfrac{56}{100} = 0.56$

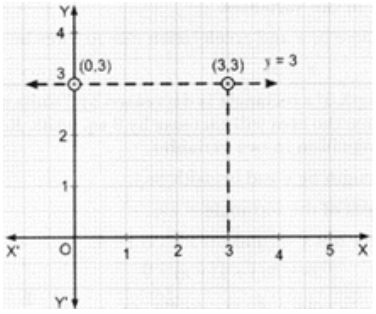
4. Two pair of adjacent sides of a kite are equal.
   So, the sides of the given kite are 5cm, 5cm, 7cm, 7cm
   ∴ Perimeter of the kite = 5 + 5 + 7 + 7 = 24cm

SECTION-B

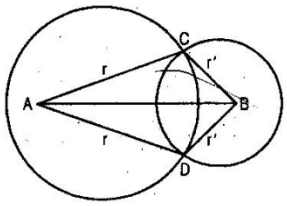
Question number **5** to **10** carry **two** marks each.

5. Given equation is 3x + 2y = 9
   $\Rightarrow y = \dfrac{9-3x}{2}$
   When x =1 $y = \dfrac{9-3}{2} = \dfrac{6}{2} = 3$
   When x =-1 $y = \dfrac{9+3}{2} = \dfrac{12}{2} = 6$
   ∴ Two solution of the given equation are (1, 3), (-1 ,6)

6. Any straight line parallel to x – axis is given by y = a, where 'a' is the distance of the line from the x – axis.
   Here a = 3. Therefore the equation of the line is y = 3. To draw the graph of this equation plot the points (0, 3) and (3,) and join them.



7. Let two circles with respective centers A and B intersect each other at points C and D.



We have to prove $\angle$ACB = $\angle$ADB

Proof: In triangles ABC and ABD,

AC = AD = r

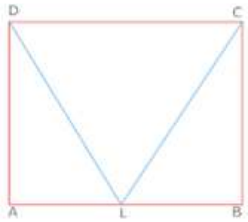
BC = BD = r

AB = AB [Common]

$\therefore \Delta ABC \cong \Delta ABD$ [SSS rule of congruency]

$\Rightarrow \angle$ACB = $\angle$ADB [By CPCT]

8. Area of rectangle ABCD = 100 square cm



Area $\Delta LCD = \frac{1}{2}$ area rectangle ABCD

$= \frac{1}{2} \times 100$ square cm

=50 square cm

9. $\frac{2}{3}x + 4y = -7$

$\frac{2}{3}x = -7 - 4y$

$2x = 3(-7 - 4y)$

$x = \frac{-21 - 12y}{2}$

10. Here, n = 50, $\bar{x} = 80.4$

So, $\bar{x} = \frac{\sum x_i}{n}$

$80.4 = \frac{\sum x_i}{50}$

$\sum x_i = 80.4 \times 50 = 4020$

Correct value of $\sum x_i$ = 4020 – 69 + 96

=4047

Correct mean = $\frac{\text{correct value of } \sum x_i}{n} = \frac{4047}{50} = 80.94$

SECTION-C

Question numbers **11** to **18** carry **three** marks each.

11. (5x + 1)(x + 3) – 8 = 5(x + 1)(x + 2)

$(5x^2 + 15x + x + 3) - 8 = 5(x^2 + 2x + x + 2)$

$5(x^2 + 16 + 3 - 8) = 5(x^2 + 3x + 2)$

$5x^2 + 16x - 5 = 5x^2 + 15x + 10$

16x – 15x =15

x = 15

12. Let the cost of toy horse be Rs x and cost of one ball be Rs y.

∴ Cost of three balls = 3y

According of the given condition, we have

x = 3y … (i)

For graph,

(a) Taking y = 1, in equation (i) we get

∴ x = 3(1) = 3

(b) Taking y = 2, in equation (i), we get

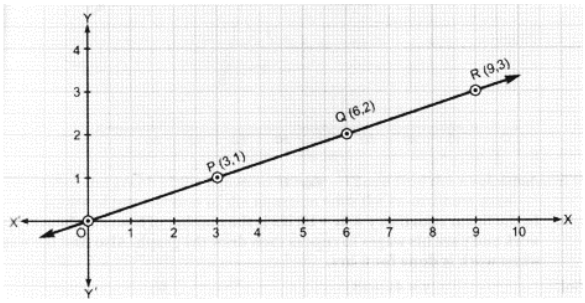
∴ x = 3(2) = 6

(c) Taking y = 3, in equation (i), we get

∴ x = 3(3) = 9

x	3	6	9
y	1	2	3
	P	Q	R

Now draw a graph taking P(3, 1), Q(6, 2) and R(9, 3) which is given below.



13. Since, OC = OB (Radii of the same circle)

$\angle OBC = \angle OCB$

$\angle OBC = 57°$

In ΔOBC, we have

$\angle OBC + \angle BOC + \angle OCB = 180°$

$57° + \angle BOC + 57° = 180°$

$\angle BOC = 66°$

In ΔOAB, we have

$\angle OAB + \angle OBA + \angle AOB = 180°$ $\begin{pmatrix} AO = OB \\ \angle OAB = \angle OBA \end{pmatrix}$

$30° + 30° + \angle AOB = 180°$

$\angle AOB = 180° - 60°$

$\angle AOB = 120°$

$\angle AOC = \angle AOB - \angle BOC = 120° - 66° = 54°$

14. $\frac{\text{Curved surface area of cylinder}}{\text{Curved surface area of cone}} = \frac{2\pi rh}{\pi rl} = \frac{2\pi rh}{\pi r\sqrt{r^2+h^2}}$

$\frac{8}{5} = \frac{2h}{\sqrt{r^2+h^2}}$

$\frac{64}{25} = \frac{4h^2}{r^2+h^2}$

$64r^2 + 64h^2 = 100h^2$

$64r^2 = 100h^2 - 64h^2$

$64r^2 = 36h^2$

$\frac{r^2}{h^2} = \frac{36}{64} = \frac{9}{16}$

$\frac{r}{h} = \frac{3}{4}$

Therefore, r:h = 3:4

15. Let radii of the bases of two domes be r and R.

$2\pi r = 17.6$

$2\times\frac{22}{7}\times r=17.6$

$r=\frac{17.6\times7}{2\times22}=2.8cm$

and $2\pi R=70.4$

$2\times\frac{22}{7}\times R=70.4$

$R=\frac{70.4\times7}{2\times22}=11.2cm$

Now, area of two hemispherical domes = $2\pi r^2+2\pi R^2$

$2\times\frac{22}{7}\times2.8\times2.8\times2\times\frac{22}{7}\times11.2\times11.2$

$49.28 + 788.48\,cm^2$

Cost of painting at the rate of Rs.10 per cm^2 = 837.76×10

= Rs. 8377.6

16. Height of the cylindrical vessel (h) = 1 m

Capacity of the cylindrical vessel

Let V m be the radius of the base of the cylindrical vessel

Volume of the cylindrical vessel = πr^2h

$\pi r^2h=0.0154$

$\frac{22}{7}\times r^2\times1=0.0154$

$r^2=\frac{0.0154\times7}{22}$

= 0.0049

r = 0.07m

Metal sheet needed to make the cylindrical vessel

= Total surface area of the cylindrical vessel

$=2\pi r\left(r+h\right)$

$=2\times\frac{22}{7}\times0.07\left(0.07+1\right)m^2$

$=\frac{1}{7}\times44\times0.07\times1.07m^2$

$=0.4708m^2$

17. Mean marks scored by girls $(\overline{x}_1)=73$

Number of girls (n_1) = 30

Mean marks scored by boys $(\overline{x}_2)=71$

Number of boys (n_2) = 50 – 30 = 20

Mean score of the whole class $(\bar{x}_2) = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$

$= \frac{30\times 73 + 20\times 71}{30+20}$

$= \frac{2190+1420}{50}$

$= \frac{3610}{50}$

$\bar{x}_{12} = 72.2$

18. Total number of workers = 38 + 27 + 86 + 46 + 3 = 200

(i) P (person is 40 years or more) **=** P(Person having age 40 to 49 years) + P(person having age 50 to 59 years +P(person having age 60 and above)

$= \frac{86}{200} + \frac{46}{200} + \frac{3}{200}$

$= \frac{135}{200} = 0.675 = 0.68$

(ii) P (person is under 40 years) **=** P (person having age 20 to 29 years) + P(person having age 30 to 39 years)

$= \frac{38}{200} + \frac{27}{200}$

$= \frac{65}{200} = 0.325 = 0.33$

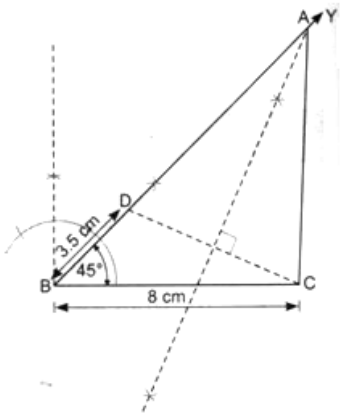
(iii) P (person having age under 60 but over 39 years) = P (person having age 40 to 49 years) + P (person having age 50 to 59 years)

$\frac{86}{200} + \frac{46}{200} = \frac{132}{200} = 0.66$

SECTION-D

Question numbers **19** to 28 carry **four** marks each.

19.



Steps of Construction

(i) Draw BC = 8 cm.

(ii) Construct $\angle YBC = 45°$.

(iii) From ray BY, cut-offline segment BD = 3.5 cm.

(iv) Join CD.

(v) Draw perpendicular bisector of CD intersecting BY at A.

(iv) Join AC to obtain the required triangle ABC.

Justification

As A lies on the perpendicular bisector of CD. Therefore,

AD =AC

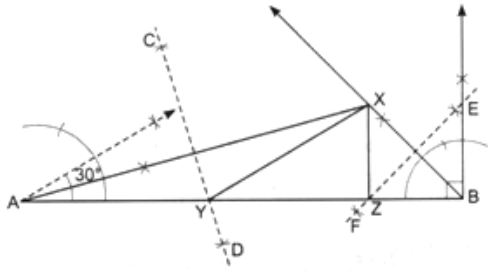
Now, BD = 3.5 cm

⇒ AB - AD = 3.5 cm

⇒ AB - AC = 3.5 cm

Hence, ΔABC is the required triangle.

20.



Steps of Construction

(i) Draw a line segment AB = 11 cm.

(ii) At A, construct an angle of $30°$ and at B construct an angle of $90°$.

(iii) Bisect these angles.

Let bisector of these angles intersect at point X.

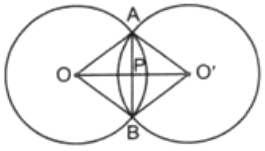
(iv) Draw perpendicular bisector CD of XA to intersect AB at Y and EF of XB to intersect AB at Z.

(v) Join XY and XZ to obtain required XYZ.

Justification

Since Flies on the perpendicular bisector of XA, Therefore,
YA = YX
$\Rightarrow \angle YAX = \angle YXA$
Similarly, Z lies on the perpendicular bisector of XB. Therefore,
ZB =ZX
$\Rightarrow \angle ZBX = \angle ZXB$
Now, AB = AY + YZ + ZB
⇒ AB = XY + YZ + ZX
In ΔXAY , we have
$\angle XYZ = \angle YXA + \angle YAX = 2\angle YAX = \angle A$
In XBZ, we have
$\angle XYZ = \angle ZBX + \angle ZXB = 2\angle ZBX = \angle B$

21. **Given:** Two circles, with centres O and O' intersect at two points A and B. AB is the common chord of the two circles and OO' is the line segment joining the centres of the two circles. Let OO' intersect B at P.



To prove: OO' is the perpendicular bisector of AB.
Construction: Join OA, OB, O'A and O'B
Proof: In triangles OAO' and OBO' we have
OO' = OO'(Common)
OA = OB (Radii of the same circle)
OA = O'B (Radii of the same circle)
$\Delta OAO' = \Delta OBO'$ (SSS congruence criterion)
$\angle AOO' = \angle BOO'$ (CPCT)
i.e., $\angle AOP = \angle BOP$
In triangles AOP and BOP we have

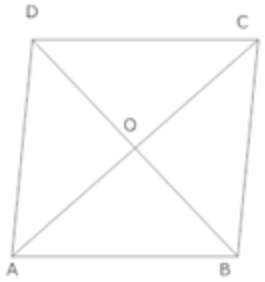
OP = OP	(Common)
$\angle AOP = \angle BOP$	(Proved above)
OA = OB	(Radio of the same circle)
$\Delta AOR \cong \Delta BOP$	(By SAS congruence criterion)
AP = BP	(CPCT)

and $\angle APO = \angle BPO$ (CPCT)
But $\angle APO + \angle BPO = 180°$ (Linear pair)
$\angle APO + \angle APO = 180°$
$2\angle APO = 180°$
$\angle APO = 90°$

Thus, AP = BP and $\angle APO = \angle BPO = 90°$

Hence, OO' is the perpendicular bisector of AB.

22. Given: A parallelogram ABCD and AC and BC are diagonals



To prove: ar (ABO) = ar (COD) = ar (BCO) = ar (AOD)

Proof: ar (ADB) = ar (ACB)

$\Rightarrow ar(ADB) - ar(ABO) = ar(ACB) - ar(ABO)$

$\Rightarrow sr(ADO) = ar(BCO).....(i)$

Ar (ADC) = ar (BCD)

$\Rightarrow ar(ADC) - ar(CDO) = ar(BCD) - ar(CDO)$

$\Rightarrow ar(ADO) = ar(AOB).....(ii)$

In triangle ABC, BO is median

$\therefore ar(ABO) = ar(BCO).....(iii)$

In triangle ADC, OD is median

$\therefore ar(ADO) = ar(CDO).....(iv)$

From (i), (ii), (iii) and (iv)

Ar(ABO) = ar (CDO) = ar (BCO) = ar (ADO)

Hence proved

23. Let the number of girls be x and number of boys be y.

$\therefore$ According to the given condition, $\frac{x}{y} = \frac{1}{3}$

On cross multiplication,

3x – y … (i)

Or

3x – y =0

For graph consider equation (i)

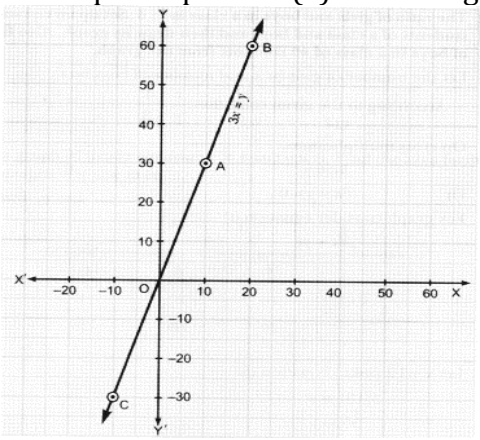
3x = y

	A	B	C
x	10	20	-10
y	30	60	-30

Let x = 10, put in equation (i)

$\therefore$ 3(10) = y

30 = y
Let x = 20, put in equation(i)
3(20) = y
60 = y
Let x = - 10, put in equation (i)
3(- 10) = y
- 30 = y
From the graph when total number of students in the class is 40.
⇒ x + y = 40
x = 40 – y
Putting the value of x in (i)
3(40 – y) = y
120 – 3y = y
120 = 4y
30 = y
∴ Number of boys is 30 and number of girls is 10.
The required point is (a) from the graph.



24. Let $r_1$cm and r_2 cm can be the inner and outer radii respectively of the pipe
Area of the outside surface = $2\pi r_2 h$ *sq unit*
Area of the inside surface = $2\pi r_1 h$ *sq unit*
∴ By the given condition
$2\pi r_2 h - 2\pi r_1 h = 44$
or $2\pi h(r_2 - r_1) = 44$
$\therefore 2\times\frac{22}{7}\times 14\times(r_2 - r_1) = 44 (\because h = 14cm)$
or $88(r_2 - r_1) = 44$
$\therefore (r_2 - r_1) = \frac{1}{2}$ (i)
Again volume of the metal used in the pipe = $\pi(r_2^2 - r_1^2)$ hcu units

$\therefore \frac{22}{7}\left(r_2^2 - r_1^2\right) \times 14 = 99$ (*given*)

$44\left(r_2^2 - r_1^2\right) = \frac{99}{44} = \frac{9}{4}$ (*ii*)

Dividing (*ii*) *by* (*i*) *we get*

$\frac{\left(r_2^2 - r_1^2\right)}{r_2 - r_1} = \frac{9}{4} \div \frac{1}{2}$

$r\frac{\left(r_2 - r_1\right)\left(r_2 + r_1\right)}{\left(r_2 - r_1\right)} = \frac{9}{4} \times \frac{2}{1}$

$\therefore \left(r_2 + r_1\right) = \frac{9}{2}$

Also, $\left(r_2 - r_1\right) = \frac{1}{2}$ [*from*(*i*)]

Adding

$2r_2 = 5$

$\therefore r_2 = \frac{5}{2}$

add,

$\frac{5}{2} + r_1 = \frac{9}{2}$

$\therefore r_1 = \frac{9}{2} - \frac{5}{2}$

$r_1 = 2$

Thus outer radius = 2.5 cm

and inner radius = 2 cm

25. Radius of the sphere $\left(r_1\right)$ = 5 cm

Radius of the base of cone $\left(r^2\right)$ = 4 cm

Let r cm be the height of the cone.

Surface area of sphere = $4\pi r^2$

$4\pi\left(5\right)^2 = 100\pi\, cm^2$

Curved surface area of cone = πrl

= $4\pi rl\, cm^2$

where l is the slant height of the cone.

According to the statement,

$100\pi = 5\left(4\pi rl\right)$

length = 5 cm

Now, $h^2 = l^2 - r^2$

$5^2 - 4^2 = 3^2$

h = 3 cm

$\therefore$ Volume of cone $= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 4^2 \times 3$

$= \frac{352}{7} cm^3 = 50.29\, cm^3$ (Approximately)

26. Let r and R be the radii of the smaller and larger spheres respectively.

We have, $r = \frac{5}{2} cm$

Volume of the smaller sphere $= \frac{4}{3}\pi r^3 = \frac{4}{3}\pi \left(\frac{5}{2}\right)^3 cm^3 = \frac{4}{3} \times \pi \times \frac{125}{8} cm^3$

Density of metal $= \frac{Mass}{Volume} = \frac{740}{\frac{4}{3} \times \frac{125}{8}\pi} gcm^{-3}$ ...(*i*)

Volume of larger sphere $= \frac{4}{3}\pi R^3$

Density of metal $= \frac{Mass}{Volume} = \frac{5920}{\frac{4}{3}\pi R^3}$ ...(*ii*)

From (i) and (ii), we have

$\frac{740}{\frac{4}{3} \times \frac{125}{8}\pi} = \frac{5920}{\frac{4}{3}\pi R^3}$

$\Rightarrow \quad R^3 = \frac{5920 \times 125}{740 \times 8} = 125$

$\Rightarrow \quad R^3 = 5^3 \quad \Rightarrow \quad R = 5\, cm$

27. Let x_1, x_2, x_3, -------, x_n be n individuals observations whose mean is $\bar{x}$. The sum of the deviations of these n observations from $\bar{x}$ is given by

$\left(x_1 - \bar{x}\right) + \left(x_2 - \bar{x}\right) + \left(x_3 - \bar{x}\right) - - - - - - - + \left(x_n - \bar{x}\right).$

Since mean of n observation x_1, x_2, x_3, -------, x is given as $\bar{x}$

$\therefore \bar{x} = \frac{x_1 + x_2 + x_3 - - - - - - + x_n}{n}$

$\Rightarrow n\bar{x} = x_1 + x_2 + x_3 - - - - - + x_n - - - -(1)$

$New \left(x_1 - \bar{x}\right) + \left(x_2 - \bar{x}\right) + \left(x_3 - \bar{x}\right) + - - - - - - \left(x_n - \bar{x}\right)$

$= \left(x_1 + x_2 + x_3 - - - - - + x_n\right) - \left(\bar{x} + \bar{x} + \bar{x} - - - - - n \text{ times}\right)$

$= \left(x_1 + x_2 + x_3 - - - - - + x_n\right) - n\bar{x}$

$= n\bar{x} - n\bar{x} \rightarrow$ using (1)

$= 0$

Hence proved

28. Total number of cards = 100

(i) even numbers are = 50

P (even number) = $\frac{50}{100} = \frac{1}{2}$

(ii) no. less than 14 are

$= (2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)$

$= 12$

P (no. less than 14) = $\frac{12}{100} = 0.12$

(iii) Number which is a Perfect square

$= \{1, 4, 9, 16, 25, 36, 49, 64, 81, 100\}$

$= 10$

P (number which is a perfect square) $= \frac{10}{100} = \frac{1}{10}$

(iv) Prime no. less than 20 are

$= \{2, 3, 5, 7, 11, 13, 17, 19\}$

$= 8$

P (Prime no. less than 20) $= \frac{8}{100} = \frac{2}{25}$

(v) P (odd number) = (1 – p)(an even no.)