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Class: 9
Subject: Mathematics
Topic: OAS1509SA201
No. of Questions: 34

Time: 3 Hrs. **M.M. 90**

General Instructions:

(i) All questions are **compulsory**.
(ii) The question paper consists of **34** questions divided into four **sections A, B, C** and **D**. **Section-A** comprises of **10** questions of **1 mark** each; **Section-B** comprises of **8** questions of **2 marks** each; **Section-C** comprises of **9** questions of **3 marks** each and **Section-D** comprises of **7** questions of **4 marks** each.
(iii) Question numbers **1** to **10** in **Sections-A** are multiple choice questions where you are required to select one correct option out of the given four.
(iv) There is no overall choice. However, internal choices have been provided in **1** question of **two marks**, **3** questions of **three marks** each and **2** questions of **four marks** each. You have to attempt only one of the alternatives in all such questions.
(v) Use of calculator is not permitted.

SECTION-A

Q1. The range of the data 14, 27, 29, 61, 45, 15, 9, 18 is
(a) 61
(b) 52
(c) 47
(d) 53

Sol. (a)

Q2. Two coins are tossed 200 times and the following out comes are recorded

HH	HT/TH	TT
56	110	34

What is the empirical probability of occurrence of at least one Head in the above case
(a) 0.33
(b) 0.34
(c) 0.66
(d) 0.83

Sol. (d)

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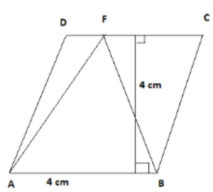
Q3. A three digit number is selected at random. What is the probability that its unit digit is 2
(a) 0.16
(b) 0.128
(c) 0.064
(d) 0.20

Sol. (d)

Q4. If three angles of a quadrilateral are 110°, 82°, 68° then its fourth angle is
(a) 100
(b) 110
(c) 68
(d) 260

Sol. (a)

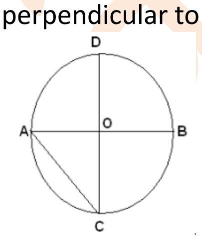
Q5. In the figure, ABCD is a parallelogram, then area of Δ AFB is



(a) $16\ cm^2$
(b) $8\ cm^2$
(c) $4\ cm^2$
(d) $2\ cm^2$

Sol. (b)

Q6. In a circle with centre O, AB and CD are two diameters perpendicular to each other. The length of chord AC is:



a. 2 AB
b. $\sqrt{2}$ AB
c. $\frac{1}{2}$ AB
d. $\frac{AB}{\sqrt{2}}$

Sol. (d)

Q7. The chord, which passes through the centre of the circle, is called a
(a) Radius of the circle.
(b) Diameter of the circle.
(c) Semicircle.
(d) None of these.

Sol. (b)

Q8. Given four points A, B, C, D such that three points A,B, C are collinear. By joining these points in order, we get
(a) a straight line
(b) a triangle
(c) a quadrilateral
(d) a Parallelogram

Sol. (b)

Q9. The area of metal sheet required to make a closed hollow cone of slant height 10 m and base radius 7 m is
(a) 220 m^2
(b) 352 m^2
(c) 704 m^2
(d) 374 m^2

Sol. (d)

Q10. The radius of a spherical balloon increases from 7 cm to 14 cm when air is pumped into it. The ratio of the surface area of original balloon to inflated one is
(a) 1 : 2
(b) 1 : 3
(c) 1 : 4
(d) 4 : 3

Sol. (c)

SECTION–B

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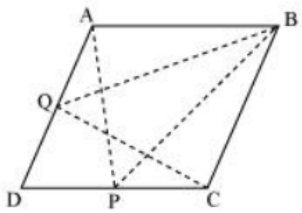
Q11. P and Q are any two points lying on the sides DC and AD respectively of a parallelogram ABCD. Show that area(ΔAPB) =area(ΔBQC).

Sol.



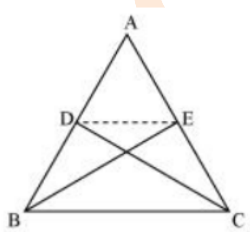
It can be observed that ΔBQC and parallelogram ABCD lie on the same base

BC and these are between the same parallel lines AD and BC.

∴ Area (ΔBQC) $=\frac{1}{2}$ Area (ABCD) ... (1)
Similarly, ΔAPB and parallelogram ABCD lie on the same base AB and between the same parallel lines AB and DC.
∴ Area (ΔAPB) = $\frac{1}{2}$ Area (ABCD) ... (2)
From equation (1) and (2), we obtain
Area (ΔBQC) = Area (ΔAPB)

Q12. D and E are points on sides AB and AC respectively of ΔABC such that area (ΔDBC) = area(ΔEBC). Prove that DE || BC.

Sol.



Since ΔBCE and ΔBCD are lying on a common base BC and also have equal

areas, ΔBCE and ΔBCD will lie between the same parallel lines.
∴DE || BC

Q13. ABCD is a rectangle in which diagonal AC bisects ∠A as well as∠C. Show that ABCD is a square.

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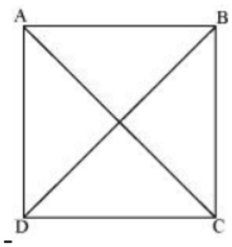
Sol.



AC bisect angles A and C

$\angle A = \angle C$

$\Rightarrow \frac{1}{2} \angle A = \angle C$

$\Rightarrow \angle DAC = \angle DCA$

CD = DA (Sides opposite to equal angles are also equal)

However, DA = BC and AB = CD (Opposite sides of a rectangle are equal)

$\therefore$ AB = BC = CD = DA

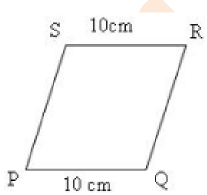
ABCD is a rectangle and all of its sides are equal.

Hence, ABCD is a square

In the figure below,

OR

The perimeter of a parallelogram PQRS is 32 cm and PQ = 10cm. Find the measures of other sides.



Sol. Perimeter of the parallelogram = 32 cm

Length of one side, PQ = 10 cm

Let the length of other side be b cm.

We know that the opposite sides of a parallelogram are equal

Thus, PQ = RS = 10 cm and PS = QR = b cm

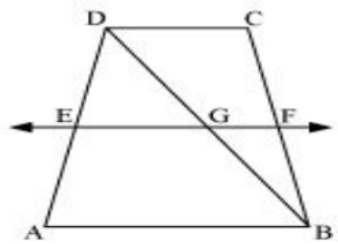
Then, PQ + QR + RS + PS = 32

2PQ + 2 PS = 16

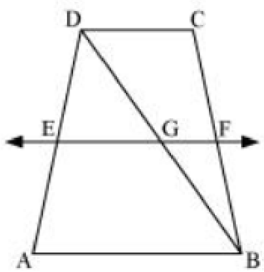
PS = 16 – 10 = 6 cm

Thus, RS = 10 cm, PS = QR = 6 cm

Q14. ABCD is a trapezium in which AB || DC, BD is a diagonal and E is the mid-point of AD. A line is drawn through E parallel to AB intersecting BC at F. Show that F is the mid-point of BC.



Sol.



Let EF intersect DB at G.
By converse of mid-point theorem, we know that a line drawn through the mid-point of any side of a triangle and parallel to another side, bisects the third side.
In ΔABD,
EF || AB and E is the mid-point of AD.
Therefore, G will be the mid-point of DB.
As EF || AB and AB || CD,
∴ EF || CD (Two lines parallel to the same line are parallel to each other)
In ΔBCD, GF || CD and G is the mid-point of line BD. Therefore, by using converse of mid-point theorem, F is the mid-point of BC.

Q15. If the point $\left(-\frac{5}{2}, \sqrt{2}\right)$ lies on the graph of the equation.
$\frac{2}{5}x - 7 = ay$ Find 'a'.

Sol. Substitute x= $-\frac{5}{2}$ and y= $\sqrt{2}$ in the linear equation $\frac{2}{5}x - 7 = ay$

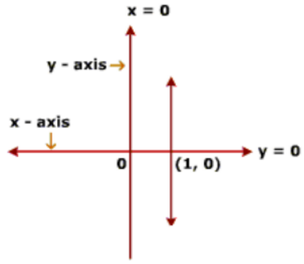
$$\frac{2}{5} \times -\frac{5}{2} - 7 = a\sqrt{2}$$

$$-1 - 7 = a\sqrt{2}$$

$$a = -\frac{8}{\sqrt{2}}$$

$$a = -4\sqrt{2}$$

Q16. Write the equation of the line shown in the figure.



Sol. The given line is parallel to the Y axis, therefore its equation is of the type x = a.
Now, the line passes through the point (1,0). This implies that a = 1.

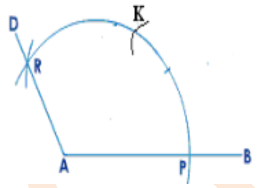
Hence the equation of the line is x = 1

Q17. Write a linear equation which passes through x = 2 and y = 3. How many such lines are possible?

Sol. $x + y = 5$.
Infinitely many lines are possible.

Q18. Construct an angle of 120° .Write the steps of construction.

Sol.



(i) Draw a line AB.
(ii) With A as centre, taking any suitable radius, draw an arc which cuts AB at P.
(iii) With P as centre and the same radius, cut the arc at K.
(iv) From K, with the same radius, cut the arc at R.
(v) Join AR and produce it to D. Then $\angle BAD = 120^\circ$.

SECTION-C

Q19. The following are the weights in kg. of 50 college students. Construct a frequency table, such that the width of each interval is 4 and the upper limit of the last class is 60.

42	42	46	54	41	37	54	44	38	45

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47	50	58	49	51	42	46	37	42	39
54	39	51	58	47	51	43	48	49	48
49	41	41	40	58	49	49	59	57	52
54	38	45	52	46	40	51	41	51	41

Sol. Largest value = 59 and the Lowest value = 37. Width of each interval is 4 and the upper limit of the last class is 60. (1 mark) Frequency distribution table is

Class	Tally marks	Frequency
36-40	~~IIII~~ III	8
41-45	IIII IIII III	13
46-50	~~IIII~~ ~~IIII~~ III	13
51-55	~~IIII~~ ~~IIII~~	10
56-60	~~IIII~~ I	6
Total		50

Q20. The table below shows students distribution per grade in a school.

Grade	Frequency
1	50
2	30
3	40
4	42
5	38
6	50

If a student is selected at random from this school, what is the probability that this student (a) is in grade 3 (b) is not in grade 2,3,4 or grade 5?

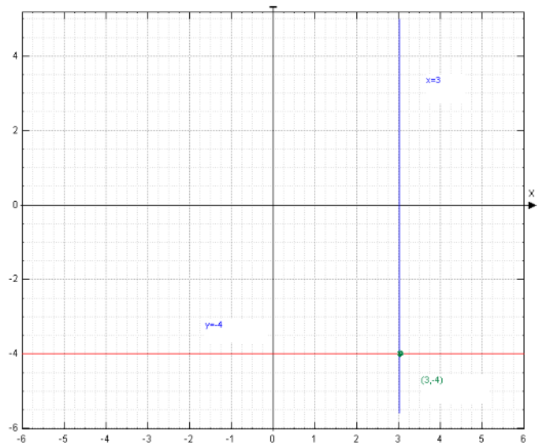
Sol. (a) Let event E be "student from grade 3".

Hence P(E)= $\frac{40}{250}$ = 0.16

(b) Let F be the event that a student is not in grade 2,3,4 or grade 5i.e student is in grade 1P(F) = $\frac{50}{250}$=0.2.

Q21. Find the quadrant in which the lines x = 3 and y = - 4 intersect graphically.

Sol.



The lines intersect in Quadrant 4

OR

Solve the given equation mx - 8 = 6 - 7(x + 3). Find the value of m for which the equation does not have any solution.

Sol. mx -8 = 6 - 7(x + 3)

$mx - 88 = 6 - 7\,(x + 3)$

$\Longrightarrow mx - 8 = 6 - 7x - 21$

$\Longrightarrow\ (m + 7)\,x = 6 + 8 - 21$

$\Longrightarrow\ (m + 7)x = -7$

$\Longrightarrow x = \frac{-7}{m+7}$

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For the equation to have a solution

M ≠ –

Q22. Laxmi purchases some bananas and some oranges .Each banana costs Rs.2 while each orange costs Rs.3. If the total amount paid by Laxmi was Rs.30 and the number of oranges purchased by her was 6, then how many bananas did she purchase?

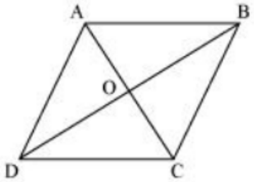
Sol. Let us assume that Laxmi purchased x bananas and y oranges. Since each banana costs Rs.2, x bananas cost Rs.2 × x = Rs.2x

Similarly, each orange costs Rs.3.

Thus, y oranges cost Rs.3 × y = Rs.3y
Thus, the total amount paid by Laxmi is Rs. (2x + 3y), which equals Rs.30
Thus, we can express the given situation in the form of a linear equation as
2x + 3y =30...(1 mark)
Now, we know that Laxmi purchased 6 oranges, i.e., the value of y is 6.
Substitute this value of y in the equation 2x + 3y = 30, thereby reducing it to a linear equation in one variable.
We can then solve the equation to obtain the value of x.
$2x + 3 \times 6 = 30$
$\Longrightarrow 2x + 18 = 30$
This is a linear equation in one variable.
$\Longrightarrow 2x = 30 - 18$
$\Longrightarrow 2x = 12$
$\Longrightarrow x = \frac{12}{2}$
$\Longrightarrow x = 6$

Q23. Show that a quadrilateral whose diagonals bisect each other at right angles is a rhombus.

Sol.



Let ABCD be a quadrilateral, whose diagonals AC and BD bisect each other at right angle i.e., OA = OC, OB = OD, and

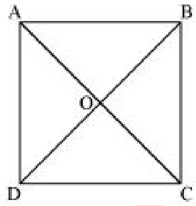
∠AOB =∠BOC =∠COD =∠AOD = 90º.

To prove ABCD a rhombus, we have
In ΔAOD and ΔCOD,
OA = OC (Diagonals bisect each other)
∠AOD =∠COD (Given)
OD = OD (Common)
∴ΔAOD ≅ ΔCOD (By SAS congruence rule)
∴AD = CD (1)
Similarly, it can be proved that
AD = AB and CD = BC (2)
From equations (1) and (2),
AB = BC = CD = AD
Since opposite sides of quadrilateral ABCD are equal, it can be said that ABCD is a parallelogram.
Since all sides of a parallelogram ABCD are equal, it can be said that ABCD is a rhombus.

OR

Show that the diagonals of a square are equal and bisect each other at right angles

Sol.



Let ABCD be a square. Let the diagonals AC and BD intersect each other at a point O. To prove that the diagonals of a square are equal and bisect each other at right angles, we have to prove
AC = BD, OA = OC, OB = OD, and AOB = 90°
AB = DC (Sides of a square are equal to each other)
ABC = DCB (All interior angles are of 90°)
BC = CD (Common side)
ABC = DCB (By SAS congruency)
AC = DB (By CPCT)
Hence, the diagonals of a square are equal in length.
In AOB and COD,
AOB = COD (Vertically opposite angles)
ABO = CDO (Alternate interior angles)
AB = CD (Sides of a square are always equal)
AOB = COD (By AAS congruence rule)
Hence, the diagonals of a square bisect each other.
In AOB and COB,

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As we had proved that diagonals bisect each other, therefore,
AO = CO
AB = CB (sides of a square are equal)
BO = BO (Common)
AOB = COB (By SSS congruency)
AOB = COB (By CPCT)
However, AOB + COB = 180 (Linear pair)
2 AOB = 180°
AOB = 90°
Hnece, the diagonals of a square bisect each other at right angles.

Q24. In the given figure, P is a point in the interior of a parallel ogram ABCD. Show that ar (ΔAPB) + ar (ΔPCD) $= \frac{1}{2} ar$ (||^{gm} ABCD)

Sol. Let us draw a line segment EF, passing through point P and parallel to line segment AB.

In parallelogram ABCD,
AB || EF (By construction) ... (1)
ABCD is a parallelogram.
∴ AD || BC (Opposite sides of a parallelogram)
⇒ AE || BF ... (2)
From equations (1) and (2), we obtain
AB || EF and AE || BF
Therefore, quadrilateral ABFE is a parallelogram.
It can be observed that ΔAPB and parallelogram ABFE are lying on the same base AB and between the same parallel lines AB and EF.
∴ Area (ΔAPB) = $\frac{1}{2}$ Area (||^{gm} ABFE) ... (3)
Similarly, for ΔPCD and parallelogram EFCD,
Area (ΔPCD) = $z = \frac{1}{2}$ Area (||^{gm} EFCD) ... (4)
Adding equations (3) and (4), we obtain
ar (ΔAPB) + ar (ΔPCD) = $\frac{1}{2}$ ar (||^{gm} ABCD)
: No. of balls = Volume of metal sphere / Volume of a spherical ball

$$= \frac{\frac{4}{3}\pi R^3}{\frac{4}{3}\pi r^3}$$

(where R is radius of sphere and r is radius of a ball)

$$= \frac{R^3}{r^3}$$

$$= \frac{10\times10\times10}{0.5\times0.5\times.05}$$

$$= 8000$$

Q25. How many balls, each of radius 0.5cm, can be made from a solid sphere of metal of radius 10cm by melting the sphere.

Sol.

Q26. The circumference of the base of a cylindrical vessel is 132 cm and its height is 25 cm. If 1000 cu.cm = 1 liter. How many litres of water can the vessel hold. (Use $=\pi \frac{22}{7}$)

Sol. The circumference of the base of a culindrical vessel is 132 cm

$\Longrightarrow 2\pi r = 132$

$\Longrightarrow 2 \times \frac{22}{7} \times r = 132$

$\Longrightarrow r = 21$

Height, h = 25

Volume of a Cylinder $= \pi r^2 h$

$= \frac{22}{7} \times 21^2 \times 25 = 22 \times 21 \times 3 \times 25 = 34650\ cm^3$

1000 cu. Cm = 1 liter

$34650\ cm^3 = 34.65l$

Q27. Find the total surface area and the height of a cone, if its slant height is 21 m and the diameter of its base is 24 m. (Use= $\pi \frac{22}{7}$)

Sol. Total Surface Area of Cone $= \pi r(l + r)$

Total Surface Area of the given Cone

$= \pi \times 12\ (21 + 12) = 1244.57\ m^2$

Height $= \sqrt{l^2 - r^2} = \sqrt{21^2 - 12^2} = \sqrt{441 - 144} = \sqrt{297} = 17.23\ m$

OR

Find the total surface area and Volume of a cone, if its height is 5m and the diameter of its base is 24 m. (Use= $\pi \frac{22}{7}$)

Sol. Total Surface Area of Cone $= \pi\, r(l + r)$

Radius of the base $= \frac{Diametre}{2} = \frac{24}{2} = 12\ m$

Slant height, $l = \sqrt{h^2 + r^2} = \sqrt{5^2 + 12^2} = \sqrt{25 + 144} = \sqrt{169} = 13m$

Total Surface Area of the given Cone

$= \pi \times 12\ (13 + 12) = 942.86\ m^2$

Volume of the cone $= \pi\, r^2\, h$

$= \pi \times 12 \times 12 \times 5 = 2262.86\ m^3$

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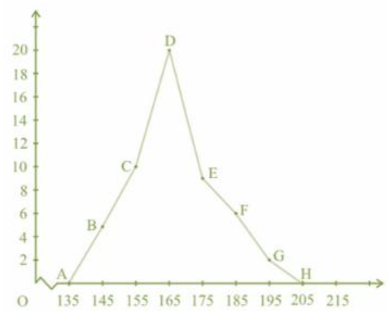
Q28. Given above is a frequency polygon drawn for data collected from daily wageworkers in a factory about their daily wages. Make a frequency distribution table for the data the frequency polygon represents.



Sol. From the frequency polygon ABCDEFGH, we observe the coordinates of the points B,C,D,E,F,G are B(145, 5), C(155, 10), D(165, 20), E(175, 9), F(185, 6) and G(195, 2).

Since these are points on the frequency polygon, the absicca is the class mark and the ordinate is the frequency
The table corresponding to these points is

Classes	Class-marks	Frequency
140-150	145	5
150-160	155	10
160-170	165	20
170-180	175	9
180-190	185	6
190-200	195	5
Total		52

SECTION-D

Given above is a frequency polygon drawn for data collected from daily wageworkers in a factory about their daily wages. Make a frequency distribution table for the data the frequency polygon represents.

Q29. A plastic box 1.5 m long, 1.25 m wide and 65 cm deep, is to be made. It is to be open at the top. Ignoring the thickness of the plastic sheet, determine the cost of sheet for it, if a sheet measuring 1 m^2 costs Rs 20.

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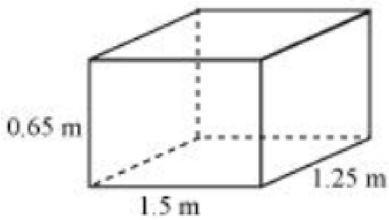
Sol.

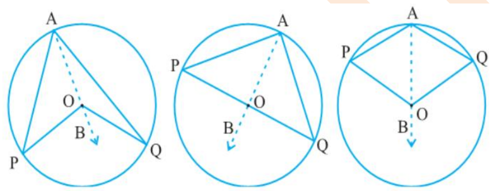


It is given that, length (l) of box = 1.5 m
Breadth (b) of box = 1.25 m
Depth (h) of box = 0.65 m
Box is to be open at top.
Area of sheet required
$= 2lh + 2bh + lb$
$= [2 \times 1.5 \times 0.65 + 2 \times 1.25 \times 0.65 + 1.5 \times 1.25]\ m^2$
$= (1.95 + 1.625 + 1.875)\ m^2 = 5.45\ m^2$
Cost of sheet per m^2 are = $Rs\ 20$
Cost of sheet of 5.45 m^2 area = $Rs\ (5.45 \times 20)$

$$= Rs\ 109$$

Q30. Prove that the angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle.

Sol.



Given: an arc PQ of a circle subtending angles POQ at the centre O and PAQ at a point A on the remaining part of the circle

To prove: ∠POQ = 2∠PAQ.

Proof: Consider the three different cases as given in Fig.
In (i), arc PQ is minor; in (ii), arc PQ is a semicircle and in (iii), arc PQ is major.
Let us begin by joining AO and extending it to a point B.
In all the cases,
∠BOQ = ∠OAQ + ∠AQO
Because an exterior angle of a triangle is equal to the sum of the two interior opposite angles.
Also in Δ OAQ,
OA = OQ (Radii of a circle)
Therefore, ∠OAQ = ∠OQA (Angles opposite to equal sides are equal) This gives∠BOQ = 2∠OAQ ………..(1)
Similarly, ∠BOP = 2∠OAP…….(2)

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From (1) and (2), ∠BOP + ∠BOQ = 2 (∠OAP + ∠OAQ)

This is the same as ∠POQ = 2 ∠PAQ (3)

For the case (iii), where PQ is the major arc, (3) is replaced by reflex angle
POQ = 2∠PAQ
Hence Proved.

Q31. Twenty four people had a blood test and the results are shown below.
A , B , B , AB , AB , B , O , O , AB , O , B , A
AB , A , O , O , AB , B , O , A , AB , O , B , A
a) Construct a frequency distribution for the data.
b) If a person is selected randomly from the group of twenty four people, what is the probability that his/her blood type is not O?

Sol.

Class	Frequency
A	5
B	6
AB	6
O	7

The number of people whose Blood group is not O = 17

The probability that a person's blood type is not O $= \frac{17}{21} = 0.71$

OR

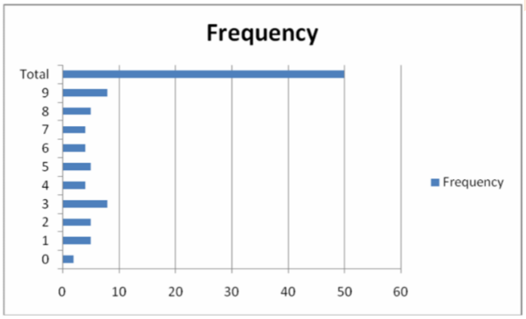
The table below gives the number of times the digit 0,1,2,3,4,5,6,7,8,9 appear in a directory of numbers.

Digit	Frequency
0	2
1	5
2	5
3	8
4	4
5	5
6	4

7	4
8	5
9	8
Total	50

(i) Construct a bar graph for this entire table taking frequency on the horizontal axis.
(ii) Find the probability of the digit 5 appearing in the number.

Sol. (i)



(i) P (digit 5) $\frac{5}{50} = \frac{1}{10}$

Q32. Three years back, a father was 24 years older than his son. At present the father is 5 times as old as the son. How old will the son be three years from now?\

Sol. Let the age of the son 3 years back be x years

Therefore, the age of the father 3 years back was x + 24

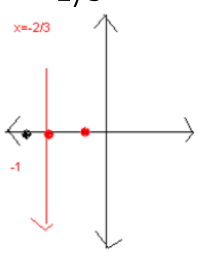
At present the age of the son is x + 3 and the father is 5 times as old as the son.

i.e., x + 24 + 3 = 5(x + 3)
i.e., x + 27 = 5x + 15
or 4x = 12 or x = 3.
Therefore, the son was 3 years old 3 years back and he will be 9 years old three years from now.

OR

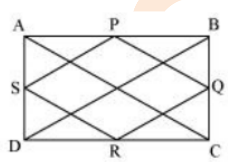
Solve the equation: $(x + 1)^3 – (x-1)^3 = 6(x^2 + x + 1)$ and plot the solution in two variables.

Sol. $(x-1)^3-(x-1)^3=6(x^2+x+1)$
$x^3+3x^3+3x+1-(x^3-3x^3+3x-1)=6x^2+6x+6$
$x^3+3x^2+3x+1-x^3+3x^3-3x+1=6x^2+6x+6$
$2=6x+6$
$6x=-4$
$x=-2/3$



Q33. ABCD is a rectangle and P, Q, R and S are mid-points of the sides AB, BC, CD and DA respectively. Show that the quadrilateral PQRS is a rhombus.

Sol.



Let us join AC and BD.

In ΔABC, P and Q are the mid-points of AB and BC respectively.

∴PQ || AC and PQ = $\frac{1}{2}$ AC (Mid-point theorem) ... (1)
Similarly in ΔADC,
SR || AC and SR = $\frac{1}{2}$ AC (Mid-point theorem) ... (2)
Clearly, PQ || SR and PQ = SR
Since in quadrilateral PQRS, one pair of opposite sides is equal and parallel to each other, it is a parallelogram.

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∴ PS || QR and PS = QR (Opposite sides of parallelogram)... (3)

In ΔBCD, Q and R are the mid-points of side BC and CD respectively.

∴ QR || BD and QR = $\frac{1}{2}$ BD (Mid-point theorem) ... (4)

However, the diagonals of a rectangle are equal.

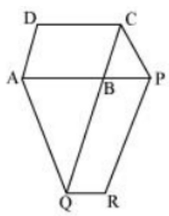
∴ AC = BD ...(5)

By using equation (1), (2), (3), (4), and (5), we obtain

PQ = QR = SR = PS

Therefore, PQRS is a rhombus. .

Q34. The side AB of a parallelogram ABCD is produced to any point P. A line through A and parallel to CP meets CB produced at Q and then parallelogram PBQR is completed (as shown in the following figure). Show that ar (||^{gm} ABCD) = ar (||^{gm} PBQR).



Sol.

Let us join AC and PQ.

ΔACQ and ΔAQP are on the same base AQ and between the same parallels AQ and CP.

Therefore, Area (ΔACQ) = Area (ΔAPQ)

⇒ Area (ΔACQ) − Area (ΔABQ) = Area (ΔAPQ) − Area (ΔABQ)

⇒ Area (ΔABC) = Area (ΔQBP) ... (1)

Since AC and PQ are diagonals of parallelograms ABCD and PBQR respectively,

Therefore, Area (ΔABC) = $\frac{1}{2}$ Area (||^{gm} ABCD) ... (2)

Area (ΔQBP) = $\frac{1}{2}$ Area (||^{gm} PBQR) ... (3)

From equations (1), (2), and (3), we obtain

$\frac{1}{2}$ Area (||^{gm} ABCD) = $\frac{1}{2}$ Area (||^{gm} PBQR)

Area (||^{gm} ABCD) = Area (||^{gm} PBQR)