**MATHEMATICS SS 2**

**THIRD TERM**

**SCHEME OF WORK**

|  |  |
| --- | --- |
| **WEEK** | **TOPIC** |
| 1 | Circle Theorem: Tangent properties of circle; Angles in alternate segment; Two tangent from a circle at external point. |
| 2 | Trigonometry: Derivative of sine rule and cosine rule and their applications. |
| 3 | Bearing and Distances; Elevation and Depression. |
| 4 | Statistics: Class boundaries, class mark, and cumulative frequencies of grouped data, and histogram. |
| 5 | Statistics: Cumulative frequency curve (Ogive); Using ogive to calculate the median, quartile, percentile and decile. |
| 6 | Review of the First Half Term Work and Periodic Test. |
| 7 | Statistics: Mean, median, and mode of grouped data. |
| 8 | Probability: Introduction; use of dice, coins and playing cards. |
| 9 | Probability: Addition and multiplication rules of probability; Mutually exclusive, independent, and complementary events; Experiment with or without replacement. |
| 10 | Revision |

**REFERENCE BOOKS**

1.New General Mathematics SSS2 by M.F. Macrae etal.

2. Essential Mathematics SSS2 by A.J.S. Oluwasanmi.

3. Exam Focus Mathematics.

**WEEK ONE**

**TOPIC:TANGENTS FROM AN EXTERNAL POINT**

**Theorem**:

**The tangents to a circle from an external point are equal.**

O

B

A

T

Given: a point T outside a circle, centre O, TA and TB are tangents to the circle at A and B.

**To prove**: |TA| = |TB|

**Construction**: Join OA, OB and OT

In ∆s OAT and OBT

OAT = OBT = 900 (radius tangent)

|OA| = |OB| (radii)

|OT| = |OT| (common side)

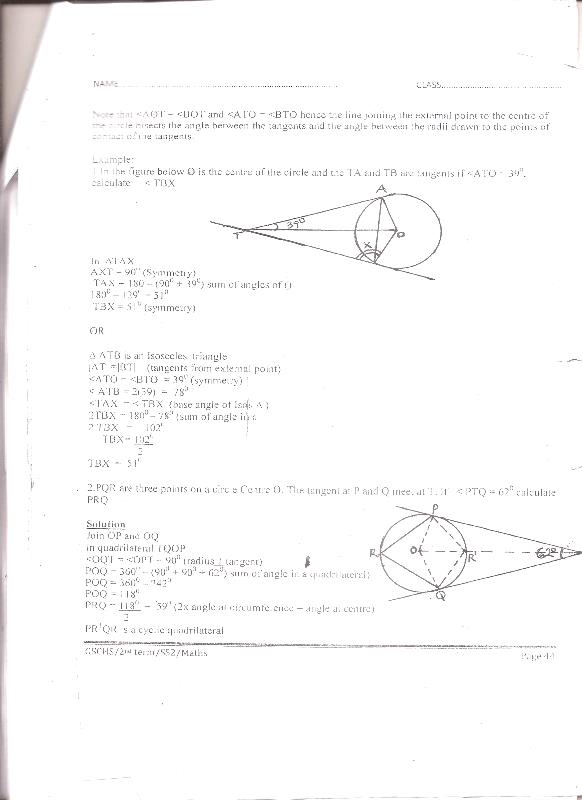
∆OAT = ∆OBT (RHS)

|TA| = |TB|

Note that <AOT = <BOT and <ATO = <BTO hence the line joining the external point to the centre of the circle bisects the angle between the tangents and the angle between the radii drawn to the points of contact of the tangents.

**Example:**

1.In the figure below O is the centre of the circle and the TA and TB are tangents if <ATO = 390, calculate < TBX



In ∆TAX

AXT = 900 (Symmetry)

TAX = 180 – (900 + 390) sum of angles of ()

1800 – 1290 = 510

TBX = 510 (symmetry)

OR

∆ ATB is an Isosceles triangle

|AT| =|BT| (tangents from external point)

<ATO = <BTO = 390 (symmetry)

< ATB = 2(39) = 780

<TAX = < TBX (base angle of Isos ∆ )

2TBX = 1800 – 780 (sum of angle in a

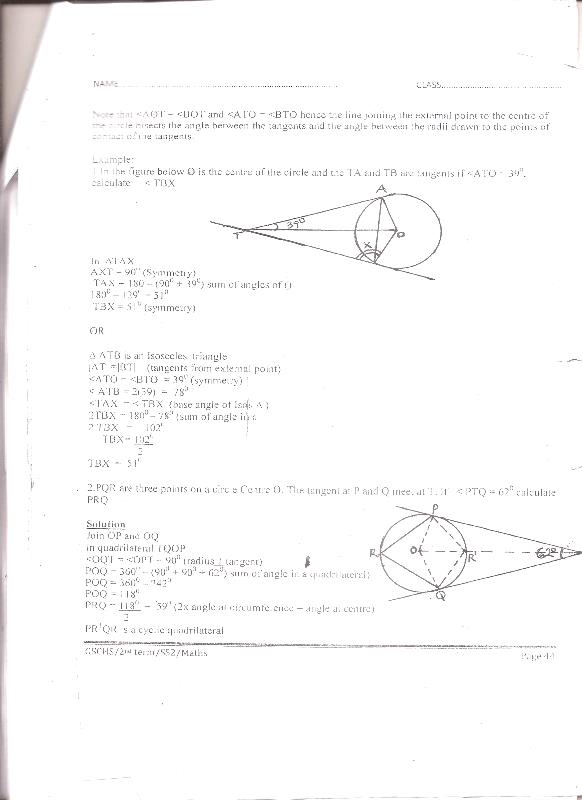
2 TBX = 1020

TBX= 1020

2

TBX = 510

2.PQR are three points on a circle Centre O. The tangent at P and Q meet at T. If < PTQ = 620 calculate PRQ.

****

**Solution**

Join OP and OQ

In quadrilateral TQOP

<OQT = <OPT = 900 (radius 1 tangent)

POQ = 3600 – (900 + 900 + 620) sum of angle in a quadrilateral)

POQ = 3600 – 2420

POQ = 1180

PRQ = 1180 = 590 (2x angle at circumference = angle at centre)

2

PR1QR is a cyclic quadrilateral

R + R1 = 1800 (opp. angles of a cyclic quadrilateral )

R1 = 1800 – R

R1 = 1800 – 590

R1 = 1210

PRQ = 590 or 1210

**Evaluation**

1. ABC are three points on a circle, centre O such that <BAC = 370, the tangents at B and C meet at T. Calculate < BTC.

A

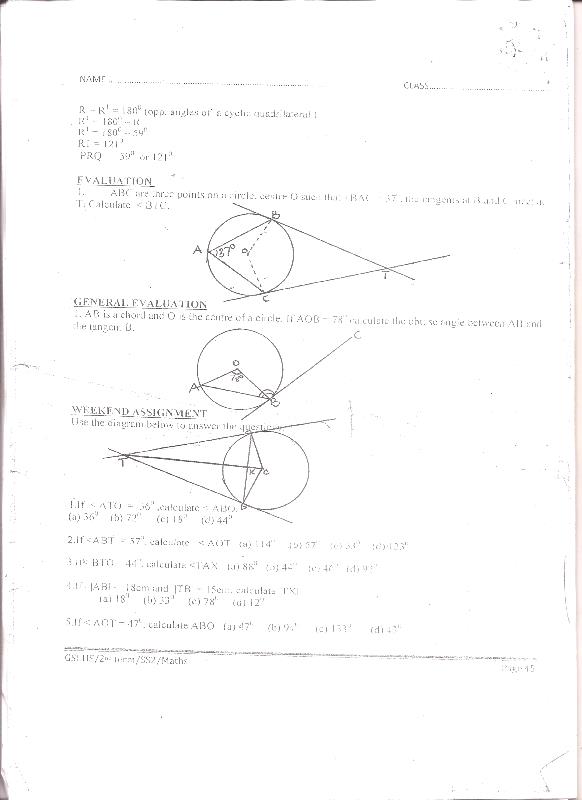
T

B

C A

**GENERAL EVALUATION/REVISION QUESTIONS**

1. AB is a chord and O is the centre of a circle. If AOB = 780 calculate the obtuse angle between AB and the tangent B.



1 The dimension of a cuboid metal is 24cm by 21cm by 10cm, if the cuboid is melted and used in making a cylinder whose base radius is 15cm find the height of the cylinder.

2 The volume of a cylinder is 3600cm3 and its radius is 10cm calculate its

(a) curve surface area

(b) total surface area

**READING ASSIGNMENT**

Essential Mathematics, pages149-151, numbers 11-20.

**WEEKEND ASSIGNMENT**

Use the diagram below to answer the questions.

B

T

xA

A

O

1.If < ATO = 360 ,calculate < ABO.

(a) 360  (b) 720  (c) 180 (d) 440

2.If <ABT = 570, calculate < AOT (a) 1140 (b) 570  (c) 330  (d) 1230

3.If< BTO = 440, calculate <TAX (a) 880 (b) 440 (c) 460 (d) 920

4.If |AB| = 18cm and |TB| = 15cm, calculate |TX|

(a) 180 (b) 330 (c) 780 (d) 120

5.If < AOT = 470, calculate ABO (a) 470 (b) 940 (c) 1330 (d) 430

**THEORY**

1.O is the centre of a circle and two tangents from a point T touch the centre at A and B. BT is produced to C. If <AOT = 670.calculate < ATC.

2.AD is a diameter of a circle,AB is a chord and AT is a tangent. a) State the size of <ADBb)If BAT is an acute angle of x0,find the size of DAB in terms of x.

**WEEK TWO**

**Topic: Cosine and Sine Rule Relating to Triangle**.

**Content**

-Sine Rule for Acute and Obtuse Angled Triangle.

-Application of Sine Rule to Triangle.

-Cosine Rule for Acute and Obtuse Angled Triangle.

-Application of Cosine Rule.

**Sine Rule for Acute and Obtuse Angled Triangle.**

Consideration is given to other triangles than a right angled triangle. The angles of any triangle are denoted by capital letters such as; A, B, C, while the sides are represented by small letters; a, b, c, respectively.

A

c b

B a C

Acute Triangle: This is a type of triangle in which the angles are less than 900.

Obtuse Triangle: Is a type of triangle in which one of the angles is more than 900 but less than 1800.

**Deductive Proof of Sine Rule**

The sine rule is the same for acute and obtuse angled triangle.

Given: Any triangle ABC (acute-angled or obtuse-angled triangle).

A

c b

B a C

To prove: a = b = c

Sin A SinB Sin C

Construction: Draw a perpendicular A to BC ( produced, if necessary)

Proof:

Sin B = h ……………………………………(1)

c

In fig. 7.10 a)

. Sin C = h ……………………………………..(2)

b

In fig.7.10 b)

Sin(1800 - C ) = h

b

Hence, Sin C = h [sin(180 – Ɵ ) = sin Ɵ] ……………(2)

b

From (1) h = c SinB

From(2) h = b Sin C

Hence, cSinB=bSinC

b = c

SinB SinC

**Example**

In triangle ABC, A= 380, B = 270, and b = 17cm. find a and c.

Solution;

Using sine rule; Sin A = Sin B

a b

A

sin 380 = sin 270 38

a 17

a = 17 sin 380

sin 270

a = 23cm C B

To find c; Angle C must be known; A + B + C = 1800

C = 1800 – 380 – 270 , C = 1150

Sin B = Sin C

b c

sin 270 = sin 1150 , c = 17 x sin 1150

17 c sin 270

c= 33.9 approximately, c = 34cm.

NB: In any triangle, the longest side correspond to the largest angle while the shortest side corresponds to the smallest angle.

**Evaluation**: 1. Solve the ∆ completely; A = 390, a = 8.2m and b = 5.6m

2.Calculate the values of angles P and R of ∆ PQR, where q = 14.35cm, p = 7.82cm and Q = 115.60

**Deductive Proof of Cosine Rule**

The cosine rule is also the same for the acute and obtuse angled triangle. A

Given: any ABC

(a) A

(b)c

bh

cb

h

B N

B a C x

a-x N x C a+x

a

To prove: c2 = a2 + b2 – 2abCos C

Construction: Draw a perpendicular from A to B(produced if necessary).

Proof: Using the acute triangle; using the obtuse triangle;

c2 = (a-x)2 + h2 c2 = (a +x)2 + h2

c2 = a2 -2ax + x2 + h2 c2 =a2+2ax+x2+h2

From ∆ ACN; b2 = x2 + h2, and Cos C = x / b From ACN,x2+h2=b2

x= b Cos C =a2+2ax+b2

c2 = a2 + b2 – 2ax From ACN,x/b=CosACN

x =bCosC =Cos(1800-C)

= -Cos C ,x= -bCos C

c2 = a2 + b2 – 2abCosC c2 = a2 + b2 +2a(-bCos C)

c2 = a2 + b2 – 2abCos C

Similarly, for other sides and angles. Therefore the cosine rule can be **written as thus:**

**c2 = a2 + b2 – 2abCosC OR Cos C = a2 + b2 – c2**

a2**= b2 + c2 – 2bcCosA 2ab**

**b2 = a2 + c2 – 2acCosB Cos A = b2 + c2 – a2**

**2bc**

**Cos B = a2 + c2 – b2**

**2ac**

**Conditions Necessary for Use**: The rule is used for solving acute and obtuse angled triangles in which two sides and included angles are given.

**Example**; Given that A = 1200, b = 7cm, c= 12cm. Solve the triangle completely.

**Solution**

Using cosine rule; a2 = b2 + c2 – 2bcCosA

a2= 72 + 122 – 2(7×12)Cos 1200

a2= 49 + 144 – 168 (-0.5)

a2 = 193 +84

a =√277

a = 16.6cm.

To find angle B, Cos B = a2 + c2 – b2

2ac

Cos B = 16.62 + 122 - 72

2x 16.6 x12

Cos B = 275.56 + 144 – 49

398.4

Cos B = 0.9301, B = cos-10.9301, B = 21.50.

To find < C; < A + < B + <C = 1800,

C = 1800 – 1200 – 21.50, C = 38.50.

Hence, a = 16.6cm, B = 21.50 and C = 38.50.

**NB: 1. In any triangle, the longest side corresponds to the largest angle and the shortestside to the smallest angle**.

**2. It is advisable to always find the smallest angle first , since the angle must be acute**.

**Evaluation**

1.Calculate the angles of the ∆s ABC whose sides are given in centimeters.Give the final answers to the nearest 0.10

a=5.2, b = 6.5cm ,c = 7.8

**General Evaluation**

1.Calculate the smallest angle in the triangle PQR such that p = 7.92m, q= 15.9m and c= 8.44m.

2.Calculate the length of the side opposite the given angle in ∆ XYZ given that x =13.1m, y = 24.2m and Z = 47.80.

**Revision Questions**

1 Given that sin Ɵ =5/13 for 0<Ɵ<900 find

a sinƟ -cosƟ

b cos Ɵ -3

tanƟ

2 If cos 3y=sin 2y find y for 0<y<900

**Weekend Assignment**

**Objectives**

Use the information below to answer question 1 – 3. In ∆ABC, a = 7.8m, b= 8.5m and B = 57.70. correct answers to 1 d.p.

1. Find A; A. 50.90 B. 510 C. 71.40 D. 700

2. Find C; A. 510 B. 71.40 C. 710 D. 800

3. What is c? A.10m B. 12m C. 9m D. 9.5m

4. In ∆ ABC, b = 4cm, c= 5cm and A = 1150. Find a to 2 s.f. A. 7.66cm B 7.6cm C.8cm D.7.7cm

5. In ∆PQR, p=1.8cm q = 2.5cm and r = 3.6cm. Calculate P. A. 27.50 B. 300 C. 320 D.280

**Theory**

1.A triangle has sides of length 7cm, 8cm, 9cm. Express the cosine of the smallest angle of the triangle as a fraction in its lowest terms.

2.Solve the triangle completely in the ∆ABC such that B = 34.50, c = 2.8cm, ⁡‽

a = 5.1cm.

**WEEK THREE**

**TOPIC: BEARINGS AND DISTANCES**

* **Bearings And Distances**
* **Angles of Elevation and Depression**

**Angle of Elevation**

This is the angle formed between the normal eye level and the line through which the observer view an object above.

A

Ө

C B

Angle ACB = Ө = Angle of elevation.

**Angle of Depression:** This is the angle formed between the eye level of the observer and the object below when the observer is above the object at view.

Angle ABC = Ө = Angle of Depression. B Ө

AC

The angle of elevation is alternate to the angle of depression and problems involving angles of elevation and depression could be solved by using the basic trigonometric ratios and in some cases the sine and cosine rule could be applied.

Sine Rule for ∆ ABC; a = b = c

Sin A Sin B Sin C

Cosine Rule: a2 = b2 + c2 – 2bc Cos A

b2  = a2 + c2 – 2ac Cos B

c2 = a2 + b2 – 2ab Cos C

**EXAMPLES**:

1. A ladder 50m long rests against a vertical wall. If the ladder makes an angle of 650 with the ground, find the distance between the foot of the ladder and the wall.

***Solution***: Q Ladder = QR, Wall = QP

Distance between the foot of the ladder and the wall = PR

50m Cos 650 = PR

50

Cross multiplying

PR = 50 x Cos 650 = 50 x0.4226

PR = 21.13m

P 650 R

1. The angle of depression of an object on the ground from the top of a tower 60m high is 550. Find the distance between the foot of the tower and the object to the nearest whole number.

***Solution:*  A**

550 Tower = AC, Object = A

Distance between the foot of the tower and

the object = BC

Tan 550 = AC, tan 550 = 60

60m BC BC

Cross multiplying; BC x Tan 550 = 60

BC = 60/tan 550

BC BC = 60/1.428 = 42.02m

BC = 42m (nearest whole number)

***EVALUATION***

From the top of a building 10m high, the angle of elevation of a stone lying on the horizontal ground is 700. Calculate correct to 1 decimal place, the distance of the stone from the foot of the building and the distance of the stone from the top of the building.

**FURTHER EXAMPLES**:

1. The angle of elevation of the top of a vertical pole from a height 1.54m above a horizontal ground is 400. The foot of the pole is on the same horizontal ground and the point of observation is 20m from the pole. Calculate correct to 3 significant figures. (i) the height of the pole (ii) the angle of depression of the foot of the pole from the point of observation.

***Solution:*E**

Pole = BE, AD = Point above the ground.

**400**

**D C**

1.54m

**A** B

20m

1. **BE =** Height of the pole = BC + CE

BC = AD = 1.54m, AB = CD = 20m (opposite & parallel sides).

To obtain CE, using triangle CDE;

Tan 400 = CE/CD, Tan 400 = CE/20

Cross multiplying; CE = 20 x tan 400 = 20 x 0.8391

CE = 16.782m

Therefore, Height of the pole (BE) = 1.54 + 16.782 = 18.322m

= 18.3m (3 sig. fig)

1. Angle of depression of the foot of the pole from point D:

Using ∆ BDC, Tan Ө = 1.54/20

Ө = tan-1(0.077) = 4.410

1. A boy observes that the angle of elevation of the top of a tower is 320. He then walks 8m towards the tower and then discovers that the angle of elevation is 430. Find the height of the tower to the nearest metre.

**Solution:**

A

320 430

D 8m C x B

Height of the tower is AB, using ∆ACB, Tan 430 = AB/x

AB = x tan 430 ……………………eqn 1

From ∆ ADB, Tan 320 = AB/(8 + x)

AB = (8 + x) tan 320 ……………………eqn 2

Equating the two equations: x tan 430 = (8 + x) tan 320

x tan 430 = 8tan 320 + x tan 320

x tan 430 – x tan 320 = 8tan 320

x(tan 430 – tan 320) = 8 tan 320

x = 8 tan 320

tan 430 – tan 320

x = 8 x 0.6249 = 4.9992

0.9325 – 0.6249 0.3076

x = 16.252m

Height of the tower = AB = x tan 430 = 16.252 x 0.9325 = 15.15499m

Height of the tower = 15.2m

***EVALUATION***

The feet of two vertical pole of height 3m and 7m are in line with a point P on the ground, the smaller pole being between the taller pole and P and at a distance of 20m from P. The angle of elevation of the top (T) of the taller pole from the top (R) of the smaller pole is 300. Calculate:

1. Distance RT (b) Distance of the foot of the taller pole from P, correct to 3 significant figures.
2. Angle of elevation of T from P, correct to one decimal place.

**BEARING AND DISTANCES**

Bearings can be defined as the angular relationships between two or more places. Bearings are specified in two ways:

Cardinal Points: It is specified in reference to the north and south. E.g N450E, S600W

Example

Taking O as the starting point.

N

W

E

S

60o

P

NOP = 600 is the bearing N600E

SOQ= S470W

47o

Q

**Three Digits Notation**: Bearing is also specified in three digits notation. E.g 0600, 0780,1350,2250 e.t.c

**Example**1. Indicate the following bearing on the cardinal point (a) 0800 (b) 2100

N

N

Solution

(a) 0800, ( b) 2100

80o

E

W

E

W

210o

S

S

2. Write each of the following in three digit notation. (a) S 700E (b) N400W

Solution:

N

(a)S 700E

S

E

W

70o

It is equivalent to 1100

E

W

N

S

(b) N 400W

40o

It is equivalent to 3200

**Evaluation**

Find the equivalent of the following in three digit notation. 1. S 750W 2. N 350E 3.S 300E 4.N620W

**Bearing of One Point from Another**;

It is possible to determine the bearing of one point or location from another point, if the starting point is known.

**Examples**

1.Find the bearing of A from B if B from A is 1400.

Solution;

A from B = ? B from A = 1400

140o

A

90

50

B

90

90

A from B =2700 + 500  =3200

2.If the bearing of P from Q is 0750, find the bearing of Q from P.

Solution;

P

P from Q = 0750

75o

R from P = 180 + 75

= 2550

75o

**Q**

**Evaluation**: Find the bearing of X from Y, if Y from X is 2100.

The Sine rule and Cosine rule are the basic rule used to solve bearing related problems.

Sine rule; Sin A = Sin B = Sin C or a = b = c

a b c Sin A Sin B Sin C

Cosine rule; c2 = a2 + b2 – 2abCosC

a2 = b2 + c2 – 2bcCosA

b2 = a2 + c2 – 2acCosB

**Examples**

1. A fly moves from a point U on a bearing of 0600, to a point V 20m away. It then moves from the point V on a bearing of 1300, to a point W. If the point W is due east of U. Find the distance of the point V from W and U from W.

Solution

V

130o

20m

50

60

110o

U

40o

60o

30o

U + V + W = 1800 ( sum of angles in a ∆ )

W = 1800 – 300 – 1100, W = 400

To find the distance V from W, using sine rule; Sin U = Sin W

u w

sin 300 = sin 400

u 20, u = 20 sin 300

sin 400

u = 15.56mdistance V from W = 15.6m (3 s.f)

Distance u from w; sin U = sin V

u v

sin 30 = sin 1100

15.6 v

v = 15.6 x sin 1100 v = 29.32

sin 30

hence, distance of u from w = 29.3m (3 s.f).

2.A village R is 10km from a point P on a bearing 0250 from P. Another village A is 6km from P on a bearing 1620. Calculate (a) distance of R from A (b)the bearing of R from A.

Solution:

R

10km

25o

P

137o

18

18

A

(a) Distance R from A, using cosine rule: p2 = q2 + r2 – 2qr Cos P

P2 = 102 + 62 – 2(10 x 6) Cos 1370

P2 = 100 + 36 – (120) x( -0.7314)

P2 = 136 + 87.768

P = √223.768, p = 14.96km

Distance R from Q = 15km approximately.

(b)Bearing of R from Q, Let the bearing be x, to find x, find A first

Sin Q = Sin P

a p

Sin A = Sin 1370

10 14.96

Sin Q = 10 x Sin1370

14.96

Q = sin-10.4559, Q = 27.10

But, Q = 18 + x

27.10=18+x

x=27.10 – 18=09.10

The bearing of R from Q is 0090.

**Evaluation**

City A is 300km due east of city B.City C is 200km on a bearing of 1230 from city B.How far is it from C to A?

**General Evaluation**:

1)Find the corresponding bearing of the following: (a)N640W (b)0640 (c)S420E (d) 2340

2)If the bearing of X from Y is N640W.Find the bearing of Y from X.

3)A boat sails 6km from a port X on a bearing of 0650 and thereafter 13km on a bearing of 1360. What is the distance and bearing of the boat from X.

4. Find the angle of elevation to the nearest degree of the top of a church tower 180m high from a point on the ground 75m from its foot.

**Revision Questions**

1 From a place 400m north of X, a student walks eastward to a place Y which is 800m from X. What is the bearing of X from Y

2 In a circle of radius 18cm, two radii form an angle of 1500 at the centre from point X and Y on the circumference. Find correct to three significant figure

(a) the length of the chord XY

(b) the length of the major arc

(c) the area of the minor segment

**Weekend Assignment**

**Objectives**

1. What is the equivalent of S700E in three digit notation? A. 1100 B. 0700 C.1200 D.1000

2. If the bearing of P from R is 0650, what is R from P? A. 2300  B.2450 C. 1200 D 0250

3. Express the true bearing 2100 as a compass bearing. A S300W B S600W C.N300W D.S600E

4. Town Q is on a bearing 2100 from town P, town R is on a bearing 1500 from town P and R is east of Q. The distance between R and P is 10km. Find the distance between R and Q. A. 10km B. 20km C.30km D. 40km

5. What is the bearing of M from N, if the bearing of N from M is 3150? A.0650 B. 0150 C. 0450  D. 0250

**Theory**

1. P, Q and R are points in the same horizontal plane. The bearing of Q from P is 1500 and the bearing of R from Q is 0600. If |PQ| = 5m and |QR| = 3m. Find the bearing of R from P correct to the nearest degree.

2.The angles of elevation of the top T, of a tower, 25m high are observed from point A at the top of a building to be 380 and from point B at the bottom of the building to be 65.40. If the tower and the building are on the same horizontal level, calculate (a) BT (B) the height of the building. Give your answers correct to 3 s.f.

**WEEK FOUR**

**TOPIC:STATIASTICS**

**CONTENT**

* Frequency Table.
* Cumulative Frequency Table.
* Histogram.

When data has a large number of values, it is cumbersome to prepare its frequency table; hence the data are organized into classes or groups to overcome this problem. E.g 0 – 4, 5 – 9, 10 – 14 e.t.c.

The range of the classes is first considered before we group the data. When data is divided into groups, it is called a grouped frequency distribution.

**Grouped frequency distribution**: The groups into which the data are arranged are called class intervals

e.g 15 – 19

***Class Limit***: The number of each class intervals is called class limits of that interval.

Consider the class interval 20 – 24,

20 = lower class limit, 24 = upper class limit

***Class Boundaries***: When data is given to the nearest unit, the class interval 34 – 37, has a lower class boundary of 33.5 and upper class boundary of 37.5.

Consider the intervals below: 20 – 24, 25 – 29 ETC. To obtain the class boundaries of 25 – 29,

24 + 25 = 24.5, 29 + 30 = 29.5

2 2

***Class Width***: This is the difference between the upper class boundary and the lower class boundary.

***Class Marks***: This is the centre or mid-point of any class interval. It is obtained by finding the average of the lower and upper limits. Find the class mark of the following class intervals 40 – 44, 45 – 49, 50 – 54 etc.

|  |  |
| --- | --- |
| **Class Interval** | **Class Mark** |
| 40 – 44 | 40 + 44 = 42  2 |
| 45 – 49 | 45 + 49 = 47  2 |

**Cumulative Frequency Table**:

This is the table that shows the cumulative frequency of each of the classes and it is the running total of the frequencies class by class, giving the total frequency.

**EXAMPLE:** In a mock examination for the final year Chemistry class, the following were obtained by 50 students.

71 63 70 45 59 82 61 79 37 89

33 56 39 42 64 73 59 67 72 60

46 36 61 87 91 67 54 72 39 43

57 65 45 52 35 46 64 37 95 86

76 73 67 71 74 82 61 59 58 43

Using class interval 31 – 40, 41 – 50 … e.t.c Construct a table showing the following columns: class interval, class boundary, class mark, frequency and cumulative frequency.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Class interval | Frequency | Class boundary | Class mark | Cumulative Frequency |
| 31 – 40 | 6 | 30.5 – 40.5 | 35.5 | 6 |
| 41 – 50 | 9 | 40.5 – 50.5 | 45.5 | 6 + 9 = 15 |
| 51 – 60 | 9 | 50.5 – 60.5 | 55.5 | 9 + 15 = 24 |
| 61 – 70 | 11 | 60.5 – 70.5 | 65.5 | 11 + 24 = 35 |
| 71 – 80 | 9 | 70.5 – 80.5 | 75.5 | 9 + 35 = 44 |
| 81 – 90 | 4 | 80.5 – 90.5 | 85.5 | 4 + 44 = 48 |
| 91 – 100 | 2 | 90.5 – 100.5 | 95.5 | 2 + 48 = 50 |

***EVALUATION***

The following figures show how many people visited an art gallery each day for 50 days.

Using class interval 11 – 20, 21 – 30 … e.t.c Construct a table showing the following columns: class interval, boundary, class mark, frequency and cumulative frequency.

30 60 53 54 35 51 13 36 43 44

44 38 39 52 45 39 25 27 31 44

29 46 49 42 47 43 34 52 50 39

53 25 28 51 54 33 35 45 51 59

19 28 34 42 48 51 20 25 37 38

**HISTOGRAM**

This is a type of bar chart, each bar corresponding to one mark and with its length proportional to the frequency of that mark. The class marks or centres, class boundaries can be used on the variable scale. In histogram, the bars are joined together and must be of equal width, except when dealing with unequal class interval.

The following table shows the distribution of marks scored by a class of 80 students.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Marks | 10 - 14 | 15 - 19 | 20 - 24 | 25 - 29 | 30 - 34 | 35 - 39 |
| Frequency | 18 | 9 | 11 | 25 | 14 | 3 |

Draw a histogram for the distribution.

**Solution**

|  |  |  |
| --- | --- | --- |
| Class Interval | Class Mark | Frequency |
| 10 - 14 | 12 | 18 |
| 15 - 19 | 17 | 9 |
| 20 - 24 | 22 | 11 |
| 25 - 29 | 27 | 25 |
| 30 - 34 | 32 | 14 |
| 35 - 39 | 37 | 3 |

25 –

Frequency

20 –

15 –

10 –

5 –

0 9.5 14.5 19.5 24.5 29.5 34.5 39.5

**Class boundaries**

**EVALUATION**

Draw a histogram to illustrate the data shown below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Heights(cm) | 120 - 129 | 130 - 139 | 140 - 149 | 150 - 159 | 160 - 169 | 170 - 179 |
| Frequency | 6 | 15 | 31 | 37 | 9 | 2 |

***GENERAL EVALUATION***

1. Construct a table showing the following columns: class interval, class boundary, class mark, frequency ,and cumulative frequency for the distribution shown below.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Shoe Sizes | 5 - 9 | 10 - 14 | 15 - 19 | 20 - 24 | 25 - 29 | 30 - 34 | 35 - 39 |
| No of students | 5 | 7 | 6 | 2 | 3 | 4 | 3 |

2. Draw a histogram for the distribution.

***WEEKEND ASSIGNMENT***:

1. The thickness of 20 samples of steel plate are measured and the results (in mm) to two significant figures are as follows:

7.3 7.1 6.6 7.0 7.8 7.3 7.5 6.2 6.9 6.7

6.5 6.8 7.2 7.4 6.5 6.9 7.2 7.6 7.0 6.8

Construct a table showing the following columns: class interval, class boundary, class mark, frequency and cumulative frequency, using class interval 6.2 – 6.4, 6.5 – 6.7 e.t.c

2. The following table shows the distribution of the masses of 120 logs of wood, correct to the nearest kg.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Masses (kg) | 15 - 24 | 25 - 34 | 35 - 44 | 45 - 54 | 55 - 64 |
| Frequency | 14 | 54 | 24 | 26 | 2 |

1. Draw a histogram for the distribution.

**WEEK FIVE**

**TOPIC: PRESENTATION OF DATA**

* Cumulative Frequency Table.
* Cumulative Frequency Curve.

**Cumulative Frequency Curve**

The cumulative frequency curve is also called the ***OGIVE***. It is the graph of the cumulative frequency against the upper class boundary.

**Example**

The table below shows the height of 200 people who were randomly picked.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Heights(cm) | 145 - 149 | 150 - 154 | 155 - 159 | 160 - 164 | 165 - 169 | 170 - 174 | 175 - 179 |
| Frequency | 5 | 18 | 50 | 29 | 80 | 14 | 4 |

Construct for the distribution above, a cumulative frequency curve.

***Solution***:

|  |  |  |  |
| --- | --- | --- | --- |
| Heights | Frequency | Cumulative Frequency | Upper Class Boundary |
| 145 – 149 | 5 | 5 | < 149.5 |
| 150 – 154 | 18 | 23 | < 154.5 |
| 155 – 159 | 50 | 73 | < 159.5 |
| 160 – 164 | 29 | 102 | < 164.5 |
| 165 – 169 | 80 | 182 | < 169.5 |
| 170 – 174 | 14 | 196 | < 174.5 |
| 175 – 179 | 4 | 200 | < 179.5 |

**EVALUATION**

The table shows the masses of a various quantities of maize sold by a farmer during the year 1985.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Mass (kg) | 40 - 43 | 44 - 47 | 48 - 51 | 52 - 55 | 56 - 59 | 60 - 63 | 64 -67 | 68 - 71 |
| Frequency | 7 | 18 | 32 | 48 | 41 | 28 | 17 | 19 |

1. Draw a cumulative frequency table. (b) Using a scale of 2cm to 4 kg on the x – axis and 2cm to 20units on the y – axis, draw the cumulative frequency curve.

**GENERAL EVALUATION**

Given the frequency distribution below. Draw a histogram and a cumulative frequency curve.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Height (cm) | 160 - 164 | 165 - 169 | 170 - 174 | 175 - 179 | 180 - 184 | 185 - 189 | 190 - 194 |
| Frequency | 10 | 25 | 40 | 56 | 44 | 20 | 5 |

**WEEKEND ASSIGNMENT**

The following table shows the distribution of the masses of 120 logs of wood, correct to the nearest kg.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Masses (kg) | 15 - 24 | 25 - 34 | 35 - 44 | 45 - 54 | 55 - 64 |
| Frequency | 14 | 54 | 24 | 26 | 2 |

1. Draw a histogram for the distribution.

2. Make a cumulative frequency table for the distribution.

3. Draw a cumulative frequency curve for the distribution.

4. Use the graph to find the a. semi-interquartile range.b. 60th percentile.

**WEEK SIX**

**REVIEW OF THE FIRST HALF TERM WORK AND PERIODIC TEST**

**WEEK SEVEN**

**MEAN, MEDIAN AND MODE OF GROUPED DATA**

**MEAN:** The arithmetic mean of grouped frequency distribution can be obtained using:

Class Mark Method:

X = where x is the midpoint of the class interval.

Assumed Mean Method: It is also called working mean method. X = A + (∑ Fd/∑f)

Where, d = x – A, x = class mark and A = assumed mean.

***EXAMPLE:*** The numbers of matches in 100 boxes are counted and the results are shown in the table below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of matches | 25 - 28 | 29 - 32 | 33 - 36 | 37 - 40 |
| Number of boxes | 18 | 34 | 37 | 11 |

Calculate the mean (i) using class mark (ii) assumed mean method given that the assumed mean is 30.5.

*Solution:*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Class interval | F | X | FX | d = x - A | Fd |
| 25 - 28 | 18 | 26.5 | 477 | * 4 | * 72 |
| 29 - 32 | 34 | 30.5 | 1037 | 0 | 0 |
| 33 - 36 | 37 | 34.5 | 1276.5 | 4 | 148 |
| 37 - 40 | 11 | 38.5 | 423.5 | 8 | 88 |
| Total | 100 |  | 3214 |  | 164 |

1. Class Mark Method: X = = 3214/100 = 32. 14 = 32 matches per box (nearest whole no)
2. Assumed Mean Method: X = A + (∑ Fd/∑f)

= 30. 5 + (164/100) =30.5 + 1.64

= 32.14 = 32 matches per box (nearest whole number)

***EVALUATION:***

Calculate the mean shoe sizes of the number of shoes represented in the table below using (i) class mark (ii) assumed mean method given that the assumed mean is 42.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Shoe sizes | 30 - 34 | 35 - 39 | 40 - 44 | 45 - 49 | 50 - 54 |
| No of Men | 10 | 12 | 8 | 15 | 5 |

**MODE**

The mode of a grouped frequency distribution can be determined ***geometrically*** and by ***interpolation method.***

Mode from Histogram: The highest bar is the modal class and the mode can be determined by drawing a straight line from the right top corner of the bar to the right top corner of the adjacent bar on the left. Draw another line from the left top corner to the bar of the modal class to the left top corner of the adjacent bar on the right.

***Example:***

The table gives the distribution of ages of students in an institution.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Ages(year) | 16 - 18 | 19 - 21 | 22 - 24 | 25 - 27 | 28 - 30 |
| No of Students | 18 | 30 | 35 | 24 | 13 |

Draw a histogram and use your histogram to estimate the mode to the nearest whole number.

*Solution:*

|  |  |  |
| --- | --- | --- |
| Class Interval (Ages) | F | Class Boundary |
| 16 - 18 | 18 | 15.5 - 18. 5 |
| 19 - 21 | 30 | 18.5 - 21.5 |
| 22 - 24 | 35 | 21.5 - 24.5 |
| 25 - 27 | 24 | 24.5 - 27.5 |
| 28 - 30 | 13 | 27.5 - 30.5 |

35

30

25

20

15

10

5

0

15.5 18.5 21.5 24.5 27.5 30.5 Histogram

Modal class = 22 - 24

Mode = 21.5 + 0.9 = 22.4, approximately 22 yrs.

**MODE FROM INTERPOLATION:** The mode can be obtained using the formula.

Mode = Lm +

Where Lm = lower class boundary of the modal class.

∆1 = difference between the frequency of the modal class and the class before it.

∆2  = difference between the frequency of the modal class and the class after it.

C = class width of the modal class.

**Example**: Using the table given in the example above:

Modal class = 22 – 24, ∆1 = 35 – 30 = 5, ∆2 = 35 – 24 = 11, C = 3, Lm = 21.5

Mode = 21.5 + 5 3

5 + 11

= 21.5 + (15/16) = 21.5 + 0.9375

= 22.44, approximately 22 yrs.

**MEDIAN OF GROUPED DATA:** The median of grouped data can be determined from a cumulative frequency curve and from the interpolation formula.

Median from Cumulative Frequency Curve: The cumulative frequency curve can be used to determine the median.

EXAMPLE: The table below shows the masses of 50 students in a secondary school

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Masses (kg) | 10 - 14 | 15 - 19 | 20 - 24 | 25 - 29 | 30 - 34 | 35 - 39 | 40 - 44 |
| Frequency | 3 | 7 | 9 | 5 | 11 | 6 | 9 |

1. Prepare a cumulative frequency table for the data.
2. Draw the ogive and use your graph to find the median.

***Solution:***

50 \*

45

40 \*

35 \*

30

25 \*

20 \*

15

10 \*

5 \*

0

|  |  |  |  |
| --- | --- | --- | --- |
| Masses(kg) | Frequency | Cumulative Frequency | Upper Class Boundary |
| 10 – 14 | 3 | 3 | < 14.5 |
| 15 – 19 | 7 | 10 | <19.5 |
| 20 – 24 | 9 | 19 | <24.5 |
| 25 – 29 | 5 | 24 | < 29.5 |
| 30 – 34 | 11 | 35 | < 34.5 |
| 35 – 39 | 6 | 41 | < 39.5 |
| 40 – 44 | 9 | 50 | < 44.5 |

14.5 19.5 24.5 29.5 34.5 39.5 44.5 Upper Class Boundary

***Cumulative Frequency Curve Showing the Masses of 50 Students***.

To find the median, find (N/2) and check the table on the curve.

Therefore, N/2 = 50/2 = 25th

Check 25th on the cumulative frequency and trace to the upper class boundary.

Median = 29.5 + 0.5 = 30kg

**MEDIAN FROM INTERPOLATION FORMULA**

Median = L1 + N/2 – cfmC

fm

Where, L1 = lower class boundary of the median class.

Cfm = cumulative frequency of the class before the median class.

Fm = frequency of the median class.

C = class width of the median class.

N = Total frequency

The median class: 30 – 34, L1 = 29.5, cfm = 24, fm = 11, C = 5

Median = 29.5 + 25 - 24 x 5

11

= 29.5 + 5 = 30kg

**EVALUATION**: Calculate the modal shoe sizes and median of the number of shoes represented in the table below using interpolation and graphical method.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Shoe sizes | 30 - 34 | 35 - 39 | 40 - 44 | 45 - 49 | 50 - 54 |
| No of Men | 10 | 12 | 8 | 15 | 5 |

**GENERAL EVALUATION**:

The table below gives the distribution of masses (kg) of 40 people

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Masses (kg) | 1 - 5 | 6 – 10 | 11 -15 | 16 - 20 | 21 - 25 | 26 - 30 | 31 - 35 | 36 - 40 |
| Frequency | 9 | 20 | 32 | 42 | 35 | 22 | 15 | 5 |

1. State the modal class of the distribution and find the mode.
2. Draw a cumulative frequency curve to illustrate the distribution.
3. Use the curve in ‘2’ to estimate the median.
4. Calculate the mean of the distribution.

**WEEKEND ASSIGNMENT**

The table gives the frequency distribution of a random sample of 250 steel bolts according to their head diameter, measured to the nearest 0.01mm.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diameter (mm) | 23.06 – 23.10 | 23.11 – 23.15 | 23.16 – 23.20 | 23.21 – 23.25 | 23.26-23.30 | 23.31 – 23.35 | 23.36-23.40 | 23.41-23.45 | 23.46-23.50 |
| No of bolts | 10 | 20 | 28 | 36 | 52 | 38 | 32 | 21 | 13 |

1. State the median class and calculate the median using interpolation method.
2. Draw the histogram and use it to estimate the mode.
3. Calculate the mean value using a working mean of 23.28mm.

**WEEK EIGHT**

**TOPIC: PROBABILITY (EVENT AND OUTCOME)**

**CONTENT**

1. Definition of terms

2. Events and outcome (measuring probability)

(a) Experimental probability

(b) Theoretical probability

**DEFINITION OF TERMS**

(i)**Event**: When an experiment is performed two or more results or outcomes will be expected to happen. Each attempt is called a trial and the outcome of a trial and the outcome of a trial is called an event, usually denoted by E.

(ii)**Random Experiment**: A random experiment is a repetitive process which may result in any one of the possible outcomes of the experiment OR:

(iii)**Sample space**: The sample space of a random experiment is the set containing all the possible outcomes of the experiment OR:

Sample space is all the possible outcomes of a trail in an experiment usually denoted by S.

(iv)The number of the points in a sample space n(s), and in an event, E is n(E).

**Examples**

1. When a coin is tossed twice, all the possible outcomes i.e. the sample space

S = {HH, HT,TH, TT}

∴ n(s) = 4

2. If a die is cast once, there are six outcomes.

∴ the sample space , S = {1, 2, 3, 4, 5, 6}

∴ n(S) = 6

Suppose an event E that an even number is thrown,

then E = {2, 4, 6} and n(E) = 3.

3. A box contain 16 red, 6 white, and 18 blues balls.

The sample spaces, S = {16 + 6 + 18) balls

n (S) = 40

4. When a die is tossed twice, the outcome of the first toss S1 = (1, 2, 3, 4, 5, 6) does not influence the outcome of the second throw. S2 = (1, 2, 3, 4, 5, 6). The two outcomes are independent of each other. For instance, the chance of throwing a5 in the first toss is 1/6 does not influence the chance of the throw of 2 in the second toss (i.e. 1/6); they are Independent Event.

**Equally likely events:** Two or more events are said to be equally likely to happen if the chance of occurrence of each of the same.**e.g.**

1.In the throw of a die, there are six equally likely outcomes, S = {1, 2, 3, 4, 5, 6} the change of each occurring is 1 out of 6 c.c. 1/6.

2.From a pack of 52 cards, the chance of picking any of the cards at random is 1/52.

**PROBABILITY**

The probability of an event is the chance of its occurrence, that is the likelihood of the event happening with respect to the sample space.

Prob. Of E = number of elements in E\_\_\_

number of total elements in S

∴P(E) = n(E)

n(S)

**NOTE**: Probability of an event lies between 0 and 1 i.e. O<P(E) <1

then the prob. that it will not occur is 1 – P(E).

**EVALUATION**

1. In a class of 27 boys and 12 girls, what is the probability of picking a girl.

2. A no is chosen at random from 40 to 50, find the probability that it is a prime number.

3. If all 2-digits numbers 00, 01, 02, …….99 are equally likely to be chosen, find the probability that a number picked at random has 5 as its first digit.

**EXPERIMENTAL AND THEORETICAL PROBABILITY**

**EXPERIMENTAL PROBABILITY**

Experimental Prob = no of required outcome

no of possible outcome

**Example**

A die is rolled 200 times, the outcome obtained are shown below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | 1 | 2 | 3 | 4 | 5 | 6 |
| **No. of Outcomes** | 25 | 30 | 45 | 28 | 40 | 32 |

Find the experimental probability of obtaining (a) 6 (b) 2

(a) P(6) = n(6) = 32 = 4

n(S)200 25 = 0.16

(b) P(2) = n(2) = 30 = 3 = 0.15

n(S) 200 20

Since experimental probability uses numerical records of past events to predicts the future, its predictions are not absolutely accurate, however the probability of throwing a 2 on a fair 6-sided die is 1/6, since any one of the 6 faces is equally alike. This is an example of theoretical probability.

**THEORETICAL PROBABILITY**

Theoretical probability is the assumed value assigned to the occurrence of an event based on the assumption that each of the elements in the outcome are equally likely to happen i.e. by considering the physical nature of the given situation.

**Examples**

Tola throws a fair six-sided die, what is the probability that she throws (a) a 9 (b) a 4

(c) a no greater than 2 (d) an even no (e) either 1, 2, 3, 4, 5, or 6?

**Solution**

a. Since the faces of a six sided die are numbers 1, 2, …6, it is impossible to throw a 9.

∴ P (9) = 0

b. There is a chance out of 6 chances of throwing 4

∴ P(4) = 1/6

c. S = {1, 2, 3, 4, 5, 6} , n (S) = 6

no > 2 = {3, 4, 5, 6} , n(<2) = 4

P (no >2) = n(no>2) = 4/6 = 2/3

n(s)

d. There are 3 possible even number S = {1, 2, 3, 4, 5, 6}, n (S) = 6

even no = {2, 4, 6} n (even) = 3

P(even) = n (even) = 3/6 = ½

n (S)

e. Either 1, 2, 3, 4, 5, 6

S = {1, 2, 3, 4, 5, 6} n (S) = 6n (r) = 6.

P(r) = n(r)= 6/6 = **1**

n(S)

**Example 2**

A bag contains 3 red, 5 green and 7 white balls, if a ball is selected from the bag, what is the probability that the ball is green?

Total no. of balls, n(S) = 3 + 5 + 7 = 15

Event E = green balls ∴n(E) = 5

∴P(E) = n(E) = 5 = 1

n(S) 15 3

**EVALUATION**

Use the figure below to answer the following:

|  |  |  |  |
| --- | --- | --- | --- |
| 16 | 2 | 3 | 13 |
| 5 | 11 | 10 | 8 |
| 9 | 7 | 6 | 12 |
| 4 | 14 | 15 | 1 |

(a) If a number is picked at random from the figure. What is the probability that it is:-

(i) Odd (ii) Prime (iii) even (iv) less than 10

(v) Exactly divisible by 3 (vi) a perfect square (vii) a perfect cube?

(b) If a row or column is picked at random from the figure. What is the probability that the total of its no is(i) 34 (ii) 35

**GENERAL EVALUATION**

1 A bag contains black balls, 3 green balls and 4 red balls, A ball is picked form the bag at random, what is the probability that it is

(a) Black (d) yellow (c) Green (d) not black (d) either black ore red

2 A school contains 357 boys and 323 girls, if a student is chosen at random, what is the probability that a girl is chosen.

**WEEKEND ASSIGNMENT**

**OBJECTIVE**

1 What is the probability of throwing a number greater than 4 with a single fair die.

(a) ½ (b) 1/3 (c) 5/6 (d) 2/3

2 A number is chosen at random from the set (11, 12, 13, ….25) what is the probability that the number is odds?(a) 7/15 (b) 8/15 (c) 1/4 (d) 3/4

3 A box contains 8 blues 6 yellow and 10 green balls , one all is picked at random from the box, what is the probability that the ball is yellow. (a) 1/3 (b)½ (c) 3/4 (d) 5/12

4 A coin is tossed twice, what is the probability of obtaining at least a head

(a) 3/4 (b) 1/3 (c) 2/5 (d) 1/2

5 A letter is chosen at random from the word PROBABILITY, what is the probability that the letter is a vowel? (a) 3/11(b) 4/11 (c) 5/11 (d) 6/11

**THEORY**

1 Two groups of male students X and Y cast their votes in an election of an officer; he results are as shown in the table below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | In favour | Against |  |
| Group X | 152 | 48 | 200 |
| Group Y | 88 | 62 | 150 |
|  | 240 | 110 |  |

a. How many students participate in the election?

b. If a student in favour of the officer is selected, what is the probability that he is from group X?

c. A student is choosen at random, what is the probability that he is against the officer?

2 A ltter is choose at random from the alphabet. Find the probability that it is (a) M (b) not A or Z (c) Either P, Q, R, or S (d) One of the letters of NIGERIA.

**WEEK NINE**

**TOPIC: PROBABILITY**:

**CONTENTS**

**MUTUALLY EXCLUSIVE AND INDEPENDENT EVENTS**

**APPLICATION OF TREE DIAGRAM IN SOLVING PROBLEMS**

**Mutually Exclusive Event**

Mutually exclusive events are events which cannot together at the same time. One event will pave way for the other, in such a case the separate probability are added together probabilities are added to give the combined probability.

**Additional Law of Probability**

If event A,B,C…. are mutually exclusive, the probability of A or B or C or…. Happening is the sum of their individual probabilities.

P(A) + P(B) + P(C) + ……..

**Note**: use the addition law to solve problems that contains the word or or either/or.

**Worked Examples:**

A bag contains 3 red balls, 4 blues balls 5 white balls and 6 black balls. A ball is picked at

Random, what is the probability that it is either:

1. Red or blue
2. Blue or black
3. Red, white or blue
4. Blue, white or black
5. Neither red nor

**Solution**

P(R) = 3/18 P(B) = 4/18 P(W) = 5/18, P(BK) =6/18

(a)Pro(either red or blue) = 3/18 + 4/18 = 7/18

(b) Pro(blue or black) = 4/18 6/18

= 10/18 = 5/9

(c)P(red white or blue) = P(r) +P(w) + P(blue)

= 3/18 + 4/18 + 5/18

=12/18 = 2/3

(d) P(blue, white or black) = P(blue) + P(white) + P(black)

= 4/18 + 5/18 + 6/18

= 15/18 = 5/6

(e)P(neither Red or blue) = P(R or blue)1

= 1-P(R or blue)

= 1- 7/18

= 11/18

**Worked Example 2**

A letter is choosen at random from the word “COMPUTER” what the probability that it is

(a) either in the word cut or in the word ROPE

(b) neither in the word MET nor in the word UP?

**Solution:**

n(s) = 8

(a) P (either word CUT or ROPE) =

P (CUT) + P(ROPE)

= 3/8 + 4/8

= 7/8

(b) P(MET +UP)1 = 1- 5/8 = 3/8

**Evaluation**

F={2, 3, 7} and T = {10, 20, 30, 40}

(a) If one element is selected at random, from F, write down the probability that it is odd.

(b) If one element is selected at random from T, write down the probability that it is a multiple of 5

(c) If one element is selected at random, from FUT write down the probability of 42 or a multiple of 4

**INDEPENDENT EVENT**

Independent event are event which have no effect on each other. In such cases the

Separate probabilities are multiplied to give the combined probability.

**Product Law**

If event A, B, C is independent, the probability of A and B and C and …. Happening is

the product of their individual probabilities P(A) x P(B) x P(c) ……

**Note**: use the product law to solve problems that contains the words “and” or both/and

**Worked Example:** A coin is tossed and a die is then thrown what is the probability of getting a

head and a perfect square

**Solution**

P(H and perfect square)

P(H) = ½

(Perfect square = (1,4)

n (perfect square) = 2

n(s) = 6

P (perfect square) = 2/6 = 1/3

∴ P (H and perfect square) = `1/2 x 1/3 =

=1/6

**WorkedExample 2:**

A bag contains 3 black balls and 2 white balls

(a) A ball is taken from the bag and then replaced, A second ball is chosen, what is the probability that

(i) They are both black

(ii) One is black and one is white

(iii) at least one is black

(iv) at most one is black

**Solution.**

With Replacement

i P(BB) = 3/5 x 3/5 = 9/25

ii Probabilities that one is black and one is white = P(BW) or P(WB)

P(one white one black) = P(BW) + P(WB)

= 3/5 x 2/5 + 2/5 x 3/5

P(BW) or P(WB) = 6/25 + 6/25 = 12/25

iii Prob ( at least one is black) = P( both are black) + P(one is black)

= P(BW) + P (WB) +P(BB)

= 12/25 + 9/25

= 21/25

iv At most one is black means either one is black or non is black i.e one is black or both are white.

P(at most one black) = P(BW) + P(WB) + P(WW)

= 6/25 + 6/5 + 4/25

= 16/25

**Evaluation**

A box contains 5 blue balls 3 green balls.

(a) A ball is taken from the box and then replaced.A second is chosen is chosen,what is the probability that (i)they are both blue (ii)one blue and one is green (iii)at least one is blue

**GENERAL EVALUATION**

1.A box contains ten marbles,seven of which are black and three are red.Three marbles are drawn one after the other without replacement.Find the probability of choosing a) one red,one black and one red marble(in that order).

b) two black marbles

c) at least two black marbles

d) at most two black marbles

**READING ASSIGNMENT**

NGM SSS2,page115-116, Exercise 11b, 1-10.

**WEEKEND ASSIGNMENT**

**Objectives**

1. Two fair dice tossed together at once find the probability that the sum of the outcome is at least 10(a) 1/12 (b) 3/15 (c) 5/36 (d) 2/5

2 form a box containing 2 Red, 6 white and 5 black balls, a ball is randomly selected , what istheprobability that the selected ball is black.(a) 5/12 (b) 5/13 (c) 4/5 (d) 7/13

3. A bag contains 3 red, 4 black and 5 green identical balls, 2 balls are picked at random one after the other without replacement, find the prob that one is red and the other is green

(a) 5/22 (b) 7/23 (c) 15/132 (d) 12/13

4. A bag contains 3 white, 6 red and 5 blue identical balls, a ball is picked at random from the bag, what is the prob. that it is either white or blue? (a) 9/14 (b) 5/14 (c) 4/7 (d) 6/7

5. A bag contains red, black and green identical balls,a ball is picked andReplaced at 100 times.The table below shows the result of the 100 trails, What is the probability of picking a green ball.

|  |  |  |  |
| --- | --- | --- | --- |
| Colour | Red | Black | Green |
| No. of occurrence | 54 | 30 | 16 |
| (a)21/25 | (b)16 | (c)4/25 | (d)1/3 |

**THEORY**

1. A box contains 5 blue balls, 3 black balls and 2 red balls of the same size. A ball is selected at random, from the box and then replaced. A second ball is then selected, find the probability of obtaining.

(a) Two red balls

(b) Two blue balls or 2 black balls

(c) One black and one red ball in any order.

2. Solve the same problem if it is without replacement.