**SCHEME OF WORK MATHEMATICS**

**SS 2 MATHEMATICS**

1. Revision
2. Straight line – Gradient of straight line, Gradient of a curve., drawing of tangents to a curve
3. Inequalities

(a) Revision of linear inequalities in one variable

(b) Solutions of inequalities in 2 variables

(c) Range of values combined inequalities

1. Graphs of linear inequalities in two variables

Max and minimum values of simultaneous linear inequalities

1. App of linear inequalities in real life

Introduction to linear programming

1. Algebraic fractions
2. Simplification of fractions
3. Operations in algebraic fractions
4. Equation involving fractions
5. Undefined fraction: if Then y is undefined when ax + c = 0

7. Review of the first half term’s work and periodic test

8. Fractions (continued)

1. Substitution in fraction
2. Simultaneous equation involving fractions

9. Logic

1. Simple and compound statement
2. Logical operation and the truth tables
3. Conditional statements and indirect proofs

10. Chord properties of circles

Perpendicular bisector of chord

Distance of equal chords from the centre of the circle

Angles subtended by 2 equal chords.

11. Circle Theorems: angle properties of circle

Angle subtended by an arc at the centre is twice the one subtended at the circumference.

Angles in the same segment

Angles in a semi circle

Opposite angles of cyclic quadrilateral

12&13 Revision and Second term Examinations

**WEEK 1**

**REVISION/STRAIGHT LINE**

**GRADIENTS OF A STRAIGHT LINE AND GRADIENT OF A CURVE**

In coordinate geometry, we make use of points in a plane. A point consists of the x-coordinate called abscissa and the y-coordinate known as ordinate. In locating a point on the x – y plane x – coordinate is first written and then the y-coordinate. For example, in a given point (a, b), the value of x is a and that of y is b. Similarly, in a point (3, 5), the value of x is 3 and that of y is 5. A linear graph gives a straight line graph from any given straight line equation which is in the general form y = mx + c or ax + by + c = 0

**Example**: Draw the graph of equation 4x + 2y = 5

1. **Point of intersection of two linear equations**

Two lines y = ax +b and y2 = cx + d

Intercept when ax + b = cx + d

That is you solve the two equations simultaneously

1. **Intersection of a line with the x or y axis**

The point of intersection of a line with the x –axis can be obtained by putting y = o to find the corresponding value of x = a, say the required point of intersection gives (a, o). Similarly, for the point of intersection of a line with the y-axis, put x = o to find the corresponding value of y. If the corresponding value of y is b, the required point of intersection is (o, b)

**Example**: Find the point of intersection of the line 2x + 3y + 2 = 0 with the

i. x – axis (ii) y – axis

**Example 3**: Find the point of intersection of the lines y = 3x + 2 and y = 2x + 5

Solution

y = 3x + 2 (1)

y = 2x + 5 (2)

At the point of intersection

3x + 2 = 2x + 5

3x – 2x = 5 -2

X = 3

Substitute 3 for x in equation (1), we obtain y = 3(3) + 2 = 11.

Hence, the point of intersection is (3, 11)

**GRADIENT OF A STRAIGHT LINE**

The Gradient of a straight line is defined as the ratio

Change in y in moving from one

Change in x point to another on the line. The Gradient of a straight line is always constant.

Y axis

Gradient from A to B =

Gradient of a line that passes through points (x1, y1)

And (x2, y2) is given as gradient m =

x

y

x axis

Meaning that the gradient of the line is the ratio of increase in y to increase in x

**TANGENT OF ANGLE OF SLOPE**

In the above diagram, tan = .

Since = y2 – y1 tan = = m

And = x2 – x1

tan = m. it then follows that the gradient of a line can be defined as tangent of angle of slope.

**Example:**

Calculate the gradient and the angle of slope of the line passing through (1, 3) and (-4, 2)

**EQUATION OF A STRAIGHT LINE AND TANGENT TO A CURVE**

**EQUATION OF A STRAIGHT LINE**

Equation of a line with gradients in m and y intercept c. Equation of a line with gradient m and y intercept c is given as y = mx + c.

ii. Equation of a line passing through the point (x1, y1) with gradient.

The general equation of a line with known gradient m and which passes through the point (x1,y1) is given as m = -

Example 2

The equation of the line with gradient 2 and which passé through the point (-3, 2).

The solution (equation) of a line with known gradient and passing through the point (x1, y1) is given by -

Here, m = 2, (x1, y1) = (-3, 2)

The required equation of the line is

y – 2 = 2(x + 3)

y = 2x + 6 + 2

y = 2x + 8

y = 2x + 8

**Equation of a line passing through two given points**

The equation of a line passing through two given points (x1, y1) and (x2, y2)

Is =

iv. Double Intercept form of the equation of a line. The equation of a line which has an intercept “a” on the x – axis and intercept “b” on the y-axis is given by + = 1

**Double intercept form of the equation of a line**

The Equation of a line which has an intercept ‘a’ on the axis and intercept ‘b’ on the y-axis is given by + = 1

v. Equation of a line passing through a point and making an angle with the horizontal axis.

The equation of a line passing through the point (x1, y1) and making an angle with the horizontal axis is = tan or y – y1 = (x – x1) tan .

**Drawing Tangents to a cure**

The gradient at any particular point on a curve is defined as being the gradient of the tangent to the curve at that point the gradient of the curve at point A is the gradient of the tangent BA, that is, tan . The tangent is drawn by placing a ruler against the curve at A and drawing a line considering that the angels between the line and the curve are equal. (Note: Gradient to the horizontal line of a curve is zero because the tangent is horizontal known as a turning points (maximum/minimum)

**WRAP UP AND ASSESSMENT**

The gradients of a straight line is given as gradient = change in y / change in x.

The gradient of a curve at a point is given by the gradient of the tangent at that point.

The gradient at a turning point of any quadratic equation equals zero.

Exercise 14.5 no 1; the figure below (the text recommended) represents the graph of the function y = x2 + 4x – 5, (a) use the given tangents to find the gradient of the curve at (i) A (ii) B.

(b) Use the Graph to find the roots of the function.

(c) State the equation of the line of symmetry of the curve.

**TICKET OUT:**

Ex 14.5 Pg 194, No 2. And 4 copy and complete the table below for the function y = use a scale of 2cm for 1 unit on both axes, draw the graph of the function.

**WEEK 3**

**REVISION OF LINEAR INEQUALITIES IN VARIABLE**

The term inequality applies to any statement involving one of the symbols. Similar to ordinary equations, inequality equations too have solutions

**Rules for finding the solutions to inequality equations**

1. Add or subtract at the same expression or number to both sides of the inequality and preserve the inequality sign.
2. Multiply or divide both sides of the inequality by the same positive number and preserve the inequality sign.
3. Multiply or divide both sides of the inequality by the same negative number and reverse the inequality sign.

The expression 3x – 1 > x + 1 is a linear inequality in one variable x. Thus, a linear inequality in x is an inequality in which the highest power of x is one (unity).

Solve the following linear inequality and represent them on a number line.

A number line is used to illustrate linear inequalities in one variable. A point x = a divides the number line into 2 parts, x < a and x > a

But when x = a is included, the number line becomes

A line segment from a to be is denoted by a and it is shown below

a

b

1. 4x + 8 < 3x + 16

Subtract 8 from both sides

4x + 8 – 8 < 3x – 8 + 16

4x < 3x + 8

Subtract 3x from both sides

4x – 3x < 3x + 8 – 3x

X < + 8

0

8

X < 8

ii. 3 (x – 6) 9 (x – 1)

open the brackets

3x – 18 9x – 9

Collect like terms

3x – 9x -9 + 18

-6x + 9

Divide through by -6 and change the sign.

X

(x 2)

iii. 5 (x + 2) – 2(4x -1) > 6(2x -3)

iv.

v. 3 – 3x < 6 (-1 < x < 3)

vi. (2x + 7) - (1 – 4) < 4 + x

**Assignment;** page 95 exercise C2 number 1 to 3

**WEEK FOUR**

**SOLUTIONS OF INEQUALITIES OF TWO VARIABLES AND THE RANGE OF VALUES OF COMBINED INEQUALITIES**

A linear inequality in two variables x and y is of the form: ax + by c: ax + by < c: ax + by > c ax + by c where a, b and c are constants. A solution to an inequality is any pair of number x and y that satisfies the inequality.

**Example 2**

Determine the solution set of 5x + 2y 17

**Solution**

One solution to 5x + 2y < 17 is x =2 and y = 3 because 5(2) + 2(3) = 16, which is indeed less than 17. But the pair x = 2 and y = 3 is not the only solution. As a matter of fact, there are infinitely many solutions. If the pairs of numbers x and y is a solution, then think of this pair as a point in the plane, so the set of all solutions can be thought of as a REGION in the x –y plane.

Hence, to illustrate how to determine this region, first express y in terms of x in the inequality.

3x + 2y 17

2y -5x + 17

Y +

When x = 0, y = 8.5; when y = 0, x = 3 (show in a graph)

The shaded Region is the solution set.

**RANGE OF VALUES OF COMBINED INEQUALITIES**

-4

-4

-3

-2

-1

0

1

2

3

In the above diagram, x can possess any value between -4 and +3 inclusive Hence x -2 and x + 3 or -4 x and x +3

These two inequalities can be combined as a single inequality. Thus, -4 x + 3

**Example 3**

What is the range of values of x for which 2x + 6 > 2 and x – 4 < 1 are both satisfied?

Solution

2x + 6 > 2 x – 4 < 1

2x > 2 – 6 x < 1 + 4

2x > - 6 x < 5

X > -2

Hence x > - 2 and x < 5 or -2 < x and x < 5 or -2 < x < 5. Both inequalities are satisfied if -2 < x and x < 5 or -2 < x < 5

a) b) c)

-2

5

5

-2

**WRAP UP AND ASSESSMETNS**

AN Inequality is any statement involving one of symbols <, >, and. Simple linear inequalities can be represented on a number line.

**Ticket out ;**Pg 207 Exercise 15.1 no 2d, f & No 8

**WEEK FIVE**

**APPLICATION OF IN INEQUALITIES IN TWO VARIABLE**

**Example:**

**One class** in a school had “g’ girls and “b” boys. The class cannot take more than 40 pupils. It is found that more than half of the pupils are boys, but there are always at least 14 girls.

1. Write down three inequalities in “g” and “b”
2. Draw graphs to show these inequalities
3. Shade properly the area that correctly describes the situation above

**EXERCISE**

**A business man** employs x men and y women. He can afford to employ not more than 16 people. Because there is some heavy work to be done he needs more than 4 men. But some precise work can be done better by women so he needs at least 6 women

1. Write down three inequalities involving x and y
2. Draw a graph to show these three inequalities
3. Use your graph to find out the maximum number of men he can employ and the maximum number of women he can employ.
4. What is the smallest number of people he can employ

**Assignment**

1. The longer side of a rectangle are each “a” metres and the shorter sides are each “b” metres. The sides of the rectangle are at least 10cm and the shorter sides are less than 10cm. The perimeter is less than 50cm.
2. Write down three inequalities involving a and b
3. Draw the graph to show these inequalities
4. Shade correctly the area that best describes the above situation

**WEEK 6**

**ALGEBRAIC FRACTIONS**

**SIMPLIFYING ALGEBRAIC FRACTIONS**

To simplify an algebraic fraction means to reduce it to its lowest term. This is done by factoring out the common factors in the numerator and the denominator. When simplifying, remember, the following facts:

1. X2 – y2 = (x + y) (x – y) (difference of two squares)
2. (x + y)2 = x2 + 2xy + y2 (perfect squares)

(x – Y)2 = x2 – 2xy + y2

2. x = m

Simplify the following fractions:

1. (b)

=

c)

d)

**Assignment:** page 111, number 10 to 20

**WEEK SEVEN**

**REVISION AND MID TERM EXAMINATION**

**WEEK 8**

OPERATIONS IN ALGEBRAIC FRACTIONS

1. Simplify

=

1. Simplify

=

Factorize each term to obtain

Change to x and then invert to obtain

But x – y = -1(y – x)

= - (2x + y) = -2x – y

**WRAP UP AND ASSESSMENT**

You can simplify fractions by adding, subtracting, multiplying or dividing them. To simplify a fraction means to reduce it to its lowest term. To do this, factorize both the numerator and denominator fully.

Then cancel the common factors.

Simplify

Ii. iii.

iv. v.

**TICKET OUT**

i. if = x, evaluate

ii.

iii. if x:y = 12:5 evaluate

**WEEK 9**

**LOGIC**

A Proposition is a statement or sentence that either true or false but not both. A simple statement or proposition is a statement containing no connectives. In other words a proposition is considered simple. If it cannot be broken up into sub-propositions.

On the other hand, a compound proposition is made up of two or more propositions joined by the connectives. These connectives are and, or, if ….. Then, if and only if. They are also called logic operators.

**Logic operator symbol**

And ^

Or ˅

If…..then

If and only if ⇔

not

IF P AND Q ARE TWO STATEMENTS (OR PROPOTIONS) THEN {CONDITIONAL STATEMENTS AND INDIRECT PROOFS}

1. The statement p ^ q is called the conjunction of p ^ q. This, p ^ q means p and q.
2. The statement p v is called the disjunction of p and q. This, p v q means either p or q or both p and q.
3. The statement p is called the conditional of p and q. a conditional is also known as implication p q means if p then q or p implies q.
4. The converse of the conditional statement if p then q is the conditional statement if q then p, (ie) the converse of p q is q p.
5. The inverse of the conditional statement if p then q is the conditional statement if not p then not q. i.e. The inverse of p q is p  **q**
6. The contra positive of the conditional statement if p then q is the conditional statement if not q then not p. i.e the contra positive of p q is  **q**  p.
7. The statement p ⇔ q is called the bi conditional of p and q, where the symbol ⇔ means if and only if (or if for short). This, p⇔q means p q means p q and q p
8. The statement p is known as the negation of p Thus p means not p or “it is false that p ……’ or “it is not true that p…’
9. When a compound proposition is always true for every combination of values of its constituent statements. It is called a **TAUTOLOGY**. On the other hand, when the compound proposition is always false it is called a **CONTRADICTION**.

**THE TRUTH TABLES**

The Truth or falsify of a proposition is its truth values. A proposition that is true has a truth value T and a proposition that is false has a truth value of F.

|  |  |  |
| --- | --- | --- |
| **CONJUCTION** | **DISJUNCTION** | **CONDITIONAL** |
| P q p ^ q | P q p v q | P q p q |
| T T T | T T T | T T T |
| T F F | T F T | T F F |
| F T F | F T T | F T T |
| F F F | F F F | F F T |
| P ^ Q is true when both p and q are true | P v q is false when both p and q are false | P is false when p is T & q is F |

|  |  |
| --- | --- |
| **BICONDITIONAL** | **NEGATION** |
| P q p ⇔ q | P  **P** |
| T T T | T F |
| F T F | F T |
| F F T | Recall that other symbols used instead of  **are pI or** p p |
| P ⇔ q is true when both p and q are either both true and both false. |  |

**ASSOCIATED TERMS IN ALGEBRA OF SETS AND ALGEBRA OF PROPOSITIONS**

The structure of algebra of sets and the algebra of propositions look the same. The associated term are given in the table below.

|  |  |
| --- | --- |
| Algebra of sets | Algebra of Proposition |
| Sets A, B, C | Propositions p, q, r, |
| Union U | Disjunction V |
| Intersection | Conjunction ^ |
| Complement A’ | Negation P |
| Universal set | Tautology, t |
| Nill (empty) set | Self-contradiction f |
| Is a subject of C | Implies |
| Equals = | Is equivalent to |

For example in,

A C B p q means p implies q

Means A is a proper subset of B

**THE VALIDITY OF AN ARGUMENT**

There are two forms of reasoning used in mathematics namely, inductive reasoning and deductive reasoning.

Inductive reasoning usually lacks generality because not all possibilities have been exhausted, when we use inductive reasoning, we base our conclusions on observation or experiences.

On the other hand, deductive reasoning is the process of showing that certain statements are accepted as true. In deductive reasoning all possibilities have been exhausted and therefore a generalized conclusion can be made.

Valid argument may be referred to a deductive arguments because deductive reasoning is based on conclusions reached from valid arguments. In deductive reasoning, we start with assumptions (also called hypotheses or premises) and then draws a conclusion based on those assumptions.

An argument may be described as a set of statements or proposition called the premises which leads to a conclusion. Let P1, P2, P3 ………..Pn represent the premises of an argument and C represents the conclusion. A valid argument is one in which if the premises P1, P2, P3…… Pn are all true, the conclusion C will always be true. In other words, an argument is said to be valid if the conjunction of the compound statement i.e P1 ^ P2 ^ P3…… ^ Pn­ is tautology. If an argument is not valid, it is called invalid or a fallacy. This, argument is valid if the conclusion follows from the hypotheses.

**WRAP UP AND ASSESSMENT**

A Proposition is a statement that is either true (T) or False (F) but not both.

A compound statement or proposition is made up of two or more simple statements joined by the connectives. Ex 10.1 No 1, 2

**TICKET OUT**

Ex 10.1 No 3, 4

WEEK 10

**SOLVING PROBLEM ON CIRCLE THEOREM.**

**ANGLES AT THE CNTRE OF A CIRCLE**

**THEOREM 1**

The angle which an arc of a circle subtends at the centre of a circle is twice that which it subtends at any point on the circumference of the circle.

R

b

a

b

a

a

T

b1

2b

2a

P

Q

2aqq

Given: A circle PQR, centre O.

To prove that P Ô Q = 2 P R Q

Construction: Join RO, and extend to any point T.

Proof: Po =Ro= Qo (radii)

a = a1 (base <s of Isos. POR)

P Ô Q = a + a1 = 2a (end <s of POR)

But P Ô T + Q Ô T

Reflex of P Ô Q = 2a + 2b = 2(a +b) = 2 PRQ

angle at centre = 2 x (at circum. Of a circle).

**Corollary**

The angle is a semi circle is a right angle

Given: A semi circle3 P Q R, Centre O.

o

P

Q

R

To prove that: PRO = 900

Construction: None

Proof: PQ is a diameter (given)

P Ô Q = 1800

(< at centre = twice <s in circumference)

2PRO = 180o

Hence PRO = = 900 as required.

**Theorem 2**

Angles in the same segment of a circle and equal

D

X1

C

o

X2

A

B

Given: points on a circle ABCD, AB is an arc of the circle.

To prove that: AD B = AC B

Construction: Join D and C to A and B, as shown above

Proof: A Ô B = 2(x1 + x2)

X1 = (A Ô B)

A D B = A C B as required.

Assignment: page 117 exercise E Number 1

**WEEK ELEVEN**

**Cyclic Quadrilaterals**

A cyclic quadrilateral is a four-sided figure whose vertices lie in side and touch the circumference of the circle. The opposite angles of C Cyclic quadrilateral lie in the opposite segment of the circle

**Theorem 3**

Opposite angles of a cyclic quadrilateral are supplementary.

Given: A cyclic quadrilateral PQRS

To prove that: P Q R + P S R = 180o

Construction: Join PO and RO of the circle.

Q

y

2x

o

2y

P

R

S

Proof; P Ô R = 2y (< at Centre = twice on the circumf.)

2x + 2y = 360o (<s at a point)

2(x +y) = 360o

X + y = 180o

P ÔR + PSR = 180o

**Assignment**

Prove that if a straight line touches a circle a circle at a point, and from the point of contact a chord is drawn then the acute angles which this chord makes with the tangents are equal to the angle in the alternate segment.

1. Page 132 number 17 - 20