Chapter - 30 Assessment - 2

(Assorted random problems of mostly algebra based on chapters 21 to 29).
(Teachers, these can be used for assessment)

30.1 Addition

a. 200 + 20 – 100 –10
b. 201 + 21 – 101 – 11
c. 221 + 21 – 121 – 11
d. 221a + 21 – 121a – 11
e. 221a + 21a – 121a – 11a
f. 21a + 1a – 21a – a
g. 20a + a – 19a – a
h. 10a + 2a – 11a – a
i. 10a + 2 – 9a – 1
j. 10a + 2 + 1 – 9a –3

30.2 Number Sequence

a. 11, 13, _, _, 19, _, _, 25
b. 10, 12, _, 16, _, _, 22, _,
c. 100, 95, _, _, 80, _, _,
d. 60, _, 50, _, 40, _, _,
e. x, 2x, _, _, 5x, _, _,
f. 2x, 4x, _, _, 10x, _, _,
g. 50x, 45x, _, _, 30x, _, _,
h. 18x, _, 12x, _, 6x, _, _,
i. 2, 4, 8, _, 32, _,
j. 2x, _, $8x^3$, _, _,

30.3 Fractions – Equivalence

a. $\frac{2}{3}=\frac{4}{?}=\frac{10}{?}$
b. $\frac{4}{3}=\frac{8}{?}=\frac{20}{?}$
c. $\frac{2x}{3}=\frac{4x}{?}=\frac{10x}{?}$
d. $\frac{2a}{5x}=\frac{4a}{?}=\frac{10a}{?}$
e. $\frac{2}{3}=\frac{?}{3x}=\frac{22}{?}=\frac{?}{15y}$
f. $\frac{a}{a^2}=\frac{a2}{?}=\frac{10a4}{?}=\frac{ka^3}{?}$
g. $\frac{a(a+1)}{2}=\frac{?}{2 \text{ x } 4}$
h. $\frac{a}{b}=\frac{a \text{ x } 4}{b \text{ x } ?}=\frac{a \text{ x } ?}{b \text{ x } (b+1)}$

30.4 Fractions – Simplifying

a. $\frac{75}{100}$ b. $\frac{2 \text{ x } 3 \text{ x } 4}{10 \text{ x } 18 \text{ x } 2}$ c. $\frac{999}{444} \text{ x } \frac{2}{3}$ d. $\frac{3x \text{ x } 25y}{4y \text{ x } 5x}$ e. $\frac{a^2 \text{ x } b \text{ x } c^3 \text{ x } d}{d^2 \text{ x } c^2 \text{ x } b^2 \text{ x } a^2}$

30.5 Fractions – Modifying

a. $\frac{2}{3}=\frac{4}{?}=\frac{10}{?}$
b. $\frac{4}{3}=\frac{8}{?}=\frac{20}{?}$
c. $\frac{?}{5}=\frac{9}{15}=\frac{?}{50}$
d. $\frac{2a}{3}=\frac{4a}{?}=\frac{10a}{?}$
e. $\frac{?}{5x}=\frac{9}{15x}=\frac{?}{50x}$
f. $\frac{2a}{5x}=\frac{4a}{?}=\frac{10a}{?}$
g. $\frac{2}{3}=\frac{?}{3x}=\frac{20}{?}=\frac{?}{15a}$
h. $\frac{a}{a^2}=\frac{a2}{?}=\frac{10a^4}{?}=\frac{ka^3}{?}$
i. $\frac{a(a+1)}{1 \text{ x } 2}=\frac{?}{2 \text{ x } 4}$
j. $\frac{a}{b}=\frac{a \text{ x } 4}{b \text{ x } ?}=\frac{a \text{ x } ?}{b \text{ x } (b+1)}$

30.6 Fractions – Addition

a. $\frac{1}{3}+\frac{1}{2}$
b. $\frac{1}{3}+\frac{1}{7}$
c. $\frac{1}{3}+\frac{1}{2}+\frac{1}{7}$
d. $\frac{2}{3}+\frac{3}{4}+\frac{5}{7}$
e. $-\frac{1}{3}+\frac{1}{2}$
f. $-\frac{1}{3}+\frac{1}{2}+\frac{1}{7}$
g. $-\frac{2}{3}-\frac{3}{4}+\frac{5}{7}$
h. $-\frac{2}{3}+3+\frac{5}{7}$
i. $\frac{2x}{3}+\frac{3x}{4}+\frac{5x}{7}$
j. $\frac{2}{3x}+\frac{3}{4x}+\frac{5}{7x}$

30.7 Multiplication

a. 4 x 19 b. 14 x 9 c. 99 x 13 d. 8 x 15 e. 8 x 151 f. 18 x 15
g. $(4x)$ x 19 h. (14) x $(9x)$ i. $(99x)$ x $(13x)$ j. 8 x $(15y)$
k. (8) x $(151xy)$ l. $(18x)$ x $(15y)$

30.8 Arrange in ascending order:

1. x, $8x$, $3x$, $5x$
2. x, $9x$, $4x$, $6x$ (x=2)
3. x, $9x$, $4x$, $7x$, (x=½)
4. x, x^2, x^3, $2x$ (x=2)
5. x, x^2, x^3, $2x$ (x=½)
6. (a+b), $(a+b)^2$, $(a+b)^3$, $(a+b)^4$ with a=1, b = 2
7. (a+b), $(a+b)^2$, $(a+b)^3$, $(a+b)^4$ with a = 1, b = ½ (Use calculator if you wish)
8. 101, 99, 309, 310, 9
9. 101ab, 99ab, 309ab, 310ab, 9ab
10. 101ab, 99ab, 309ab, 310ab, 9ab with a = 2, b = ½

30.9 Which is bigger?

a. $\frac{x}{4},\frac{x}{3}$ b. $\frac{a}{2},\frac{a}{3}$ c. $\frac{b}{7},\frac{b}{6}$ d. $\frac{2d}{3},\frac{d}{2}$ e. $\frac{2e}{5},\frac{e}{4}$ f. $\frac{2f}{7},\frac{f}{3}$

g. $\frac{11g}{24},\frac{7g}{12}$ h. $\frac{9h}{99},\frac{10h}{11}$ i. $\frac{x}{2},\frac{y}{3}$ with x =1 y =2

j. $\frac{a}{13},\frac{b}{7}$ with b=1, a =2

30.10 Division

a. If 41 x 19 = 779 41 x 18 =
b. If 3 x 18 = 54 103 x 18 =
c. If 3 x 18 = 54 54 ÷ 3 =
d. If 41 x 19 =779 7790 ÷ 41 =
e. (779x) ÷ (41x)
f. (54a) ÷ (18a) g. (54a) ÷ (18) h. (7790xy) ÷ (41x)

30.11 Substitution and Solve

a. $x + y = 5$ If $x = 3$ $y = 2$
b. $2x - 3y = 0$ If $x = 3$ y =?
c. If $x = 3$, $y = 2$ $2x + 3y$ =?
d. If $x = 3$, $y = 2$ $3y - 2x$ =?
e. If $x = 2$, x^2 =?
f. If $y = 3$, y^2=?
g. If $x^2 = 9$, x=?
h. If y^2= 4, y =?

30.12 Solve

a. $\frac{1}{2}x = 41$	x =?	b. $21x = 42$	x =?
c. $41x - 21 = 61$	x =?	d. $41x + 21x - 62$	x =?
e. $61 - 41x = 21$	x=?	f. $21x + 21 = 63$	x =?
g. $40x - 21 = x + 61$	x =?	h. $\frac{2x}{3}=\frac{3}{2}$	x =?
i. $\frac{12}{x}+\frac{13}{x}$ = 5	x =?	j. $\frac{12}{x}+\frac{13}{x}$ = 25	x =?
k. $\frac{12}{x}-\frac{23}{2x}=0.5$	x =?	l. $\frac{7}{a}-\frac{13}{2a}=\frac{1}{2}$	a =?
m. $\frac{b}{13}+\frac{10b}{39}=3$	b =?	n. $\frac{b}{13}+\frac{10b}{39}=\frac{1}{3}$	b =?
o. $y = y^2$	y=?	p. $y^2 - y$=0	y=?

q. $y(y-1) = 0$ y =?

r. $d^3 = d^4$, $d^4 - d^3 = 0$, $d^3(d - 1) = 0$ d=?

s. e = 2f, f = 2g, g = 2h, If h=1 e=?

t. e = 2f, f = 2g, g = 2h, If e = 64, h =?

30.13 More Substitution

1. y = 8a + 7b. Find y, if a = 5, b = 2
2. y = 8a + 7b. Find y, if a = $\frac{1}{2}$, b = $\frac{1}{7}$
3. y = 8a - 7b. Find y, if a= 5, b = 2
4. y = 8a - 7b. Find y, if a= $\frac{1}{2}$, b = $\frac{1}{7}$
5. y = 4a – 5b + 1. Find if a = b = 1
6. y = 4a – 5b + 1. Find if a = 3, b = 2
7. $y = a^2 + 2ab + b^2$. Find if a = 5, b = 2
8. $y = a^2 - 2ab + b^2$. Find if a = 5, b = 2
9. $y = (a + b)^2 – (a – b)^2$. Find if a = 4, b = 3
10. $y = (a + b)^2 – (a – b)^2$. Find if a = 2, b = 1

30.14 Addition – Bigger Terms

1. Add $a^2 + 2a + 2$ and $5a^2 – a - 2$
2. $(a^2 + ab + b^2)$ and $(19a^2 – ab + 19 b^2)$
3. $(5a^2 + 4a + 3b^2 + 2b + ab)$ and $(5ab + 4b + 3b^2 + 2a + a^2)$
4. $(9a^2 – 8a + 7b^2 – 6b + 5ab)$ and $(9ab + 8b – 7b^2 + 6a – 5a^2)$
5. Add All – (a + b +c), (a – b + c), (a – b - c), (c – a – b), (c – b – a)

30.15 Simplify

1. a x 3 x 5a
2. b x 3 x 5b x a x 6a
3. a x (-3) x 5a
4. a x 3 x (-5a)
5. (-b) x 3 x (5b) (-a) (6a)
6. (b) x 3 x (5b) (-a) (-6a)
7. (ab) x (bc) x (ca)
8. (2ab) (2bc)(2ca)
9. a (b – c) + b (c – a) + c (a – b)
10. $\frac{a}{b} \times \frac{b}{c} \times \frac{c}{a}$
11. $(-\frac{a}{b})(-\frac{b}{c})(-\frac{c}{a})$

30.16 Using Known formulas

1. $(x + 4)^2$
2. $(x - 4)^2$
3. $(a + 2b)^2$
4. $(2b – a)^2$
5. $(a – 2b)^2$
6. Find $(10.2)^2$ [Clue: Use $(a + b)^2$ formula]
7. Find $(9.8)^2$ [Clue: Use $(a - b)^2$ formula]
8. Find (10.2) x (9.8) [Clue: Use (a + b) (a - b) formula]
9. Find (994.5) x (1000.5) [Clue: Use (a + b) (a – b) formula]
10. $(a + b) (a – b) (a^2 + b^2)$
11. Factorise $x^4 - y^4$
12. Factorise $4a^2 – b^2$
13. Factorise $9x^2 – 4y^2$
14. $(x+\frac{1}{x})^2$
15. $(x-\frac{1}{x})^2$

30.17 Some verbal problems (here ‘verbal’ = given in words)

1. As in May 2009 (Mysore) prices are as follows: 1 kg sugar Rs. 30, 1 kg rice is Rs. 38, 1 coconut Rs. 10. A person buys 5 kg rice 2 kg sugar and 1 coconut. What did he spend?

2. Sum of two numbers is 15. One number is twice (= two times) the other. What are the numbers?

3. Chota ate some idles. Beta ate double of what Chota ate. Daddy ate 4 more than Beta. Mummy ate 1 less than Daddy. Total 14 idles were finished. How many did each one eat?

4. Boys and girls in each section of a school are given:
   Sec A: 30 boys, 12 girls
   Sec B: 28 boys, 12 girls
   Sec C: 32 girls, 8 boys.
   How many students (total) are there in the school? How many boys and how many girls?

5. The ratio of the ages of grandfather and grandchild is 5. 15 years from now, this ratio will become 3. What are their present ages?

6. In one section the number of boys is 9 times the number of girls. The total number of students is 30. How many girls are there?

7. In this problem, 1 girl left and in her place 1 boy joined. Now what is the ratio of boys to girls in the class?

8. In the first year electronic section, the number of girls was twice (=2 times) the number of boys. First year strength (=total number of students) was 30. How many boys, how many girls?

9. In the above electronics section, after annual exam. Class has less number of students. This is because 50% of boys failed (all girls passed). What is the total number of students in the second year? What is the ratio of girls to boys?

10. Akka's weight is 10kg more than that of Thangi. Both together went to a weighing machine and to save money, got on to the machine. Total was 70 kg. can they find out each one's weight?

11. Sum of a number and its square totals to 110. Can you find the numbers? If this total is 30, can you find the numbers? If this total is 2, can you find the numbers?

12. Keep your age a secret. Add 5 multiply by 2. Add 90. Tell me the result. I'll tell you your age. How?

30.18 Substitution in Formulas.

1a. $I = \frac{PTR}{100}$ P=1000, T = 1, R=20 Find I.

1b. In the above A = P + I Find A.

2a. V = R x i
V = 250
R = 1000
I =?

2b. In the above is obtained as amperes ('unit'). How many milliamperes? 1 ampere = 1000 milliampere

3a. F = ma
m = 1
a = 5
F =?

3b. In the above F is force, m is mass. What is the ratio of forces on a Kg mass and a ton mass (for the same a) [ton = 1000 kg]

4a. T = a + (n – 1) d a =1, d=1, n=10, T=?

4b. In the above T was called 10^{th} term. Find 12^{th} term.

5a. $V = u + at$
$u = 0$ $t = 10$ $a = 5$ $V=?$

5b. In the above t is time in seconds; V is velocity (=speed)(after t seconds). What is V after 2 seconds.

6a. $R = M + L \times V$ $M = 5.5$, $L= 0.1$, $V= 8$, $R=?$

6b. In the above, R_1 was for V =8, R_2 was for V =4 (all the others are the same) what is $R_1 – R_2$?

7. $y = mx + c$ substitute in this equation.

    1. c = 0 x = 1 y =? m = 1
    2. c= 0 x = 4 y =? m = 1
    3. c = 1 m = 1 x = 1 y =?
    4. c = 1 m = 1 x = 4 y =?
    5. c = -1 m = 1 x = 2 y =?
    6. c = -1 m = 1 x = 0 y =?

8. $y = x^2$, substitute in this equation

    1. x = 0, y =? 2. x =1, y =? 3. x =3, y =? 4. x = 4, y =?
    5. x = -1, y =? 6. x =-4, y =?

9. $A = \pi r^2$ Value of $\pi = \frac{22}{7}$
    a. Find A, if r = 7cm. What is the unit of A here?
    b. Find A, if r = 7 km. What is the unit if A here?

10. $V = \pi r^2 h$ $\pi = \frac{22}{7}$
    a. V =? If r = 7cm, h =10cm. V is expressed in what units (in your answer)?
    b. V =? If r = 7m, h =10m. V is expressed in what units (in your answer)?

11. $A_1 = a^2$, $A_2 = l \times h$
If a = 50, A_1 =? If l =40, b =60, A_2 =? Which is larger A_1 or A_2?

30.19 Solving Simple Equations.

1. x + y = 5 If x = 3, y =?
2. x – y = 1 If x = 3, y =?
3. Given x + y = 5 and x – y = 1. Find x and y [Clue: Add (LHS + LHS) = (RHS + RHS)].
4. x – y =0 If x =5, y =?
5. x – y – 2 = 0 If x = 5, y =?
6. $x^2 = 4$, x =?
7. $x^2 –4 = 0$, x =?
8. $x^2 = a2$, x =?
9. $x^2 = (a+5)^2$, x =?
10. $x^2 + a^2 + 10a = (a+5)^2$, x =?
11. $x^2 + a^2 – 10a = (a-5)^2$, x=?
12. $x^2 = y + 1$; y = 8, x=?
13. $x^2 + y^2 = 20$; $x^2 – y^2 = 12$; x =? y =? [Clue: do as in 3 above]
14. $x^2 – y^2 = 0$ If x = 5, y =?
15. $x^2 – y^2 – 2 = 0$ If x = 5, y =?
16. $x^2 – a^2 = b^2$ If a = 1, b = 2, x =?
17. $x^2 + (a - b)^2 = (a+b)^2$ If ab = 4, x =? [Clue: Use formulas of $(a+b)^2$ etc and simply

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Chapter - 31 **Basic Geometry**

31. Activity:
Make use of a dictionary (Nowadays, the 'on-line', Internet in computer, facilities contain 'dictionary' also even on the toolbar). Find the meaning of geometry and fill it up here.

31.1 Some important aspects. Geometry makes use of some words (technical terms). Since geometry is a very old subject, these technical terms have become commonly used words (in all languages of the world). So, many persons do not give much respect (thought, attention) to these. We will mention the more important ones very briefly. They are: point, line, angle, surface, area, plane, volume, shapes etc.

31.2 Point:
It shows a location. Mathematically it has no dimension i.e., it is too small (to occupy space). For our purpose, it should be seen. Points can be identified by numbers or letters. Usually capital letters (of English) are reserved for point. Eg: A, B …. P, Q etc. But O (oh!) is special. It is usually used to show starting point.

Activity:
Students can try to list out the places where points are seen (to have a function). A game can be played. 2 groups say the context and describe. Next chance for the other team. Eg: Team1 – point seen in India Map for Mysore. Team 2 – Ok. Now, Delhi has a bigger point in the same map.
Ok, etc. Some checklist. Starts in the sky/ starting of a rangoli / edges of a sharp object / mark made by a divider / polka dots on a dress / bindi.

31.3 Line:
A large number of points in contact with one another (only in one direction). This kind of geometrical description (another version: "set of adjacent points along one direction") is ok to learn and understand. For practical purposes (such as in science and engineering). "Line is a connecting link between 2 points".

31.3.1 Note for teachers:
Strict mathematicians 'Definition of Line' gives us, ordinary mortals, headache because they have hijacked this term to mean an unending entity (may be in either direction). What we call AB, a line is called by them "line segment". My request to the teachers: "please do not use such accurate statements". Use "ray" only in physics or engineering (not for groups of lines with a common point nor for a single line with direction). "Segment" is a frightening word. Do not use it for AB etc. Call AB as a "portion" or "part" of a much bigger line say CD etc.

[If you so desire, "segment" word can be reserved for circle. Similarly "sector" also].

31.3.2 To the students (Points and Lines). Points are represented by capital letters.

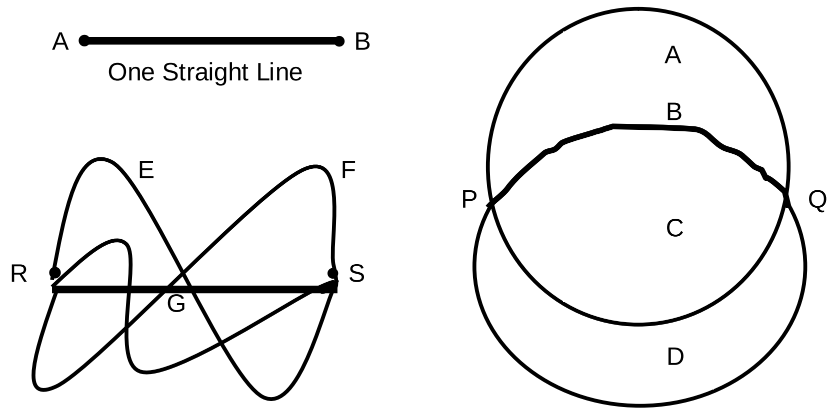
• • • •
P A B • R • S
Q

When your main aim is to draw a line, and points are only needed up to making a line, points need not even have a name.

Thus you can use a divider, lightly mark 2 points, join them and erase (or ignore) the points. This is because: The simplest way of joining 2 points is a straight line. It gives you the shortest distance also. If you are given 2 points, you can join them and thus draw a straight line.

31.3.3 Kinds of lines:
a. Straight Line – you use a scale or a real edge of any object (setsquare, side of a plate or block) to draw.

b. Curved line – any two points could be joined by curved lines also. There is only one straight line passing through 2 points. But there can be many lines between any 2 points.



Many Curved Lines

One straight line and many funny lines AB, RS are the shortest lengths between A & B, and R and S respectively. [“Respectively” means case by case, one by one, in the same order as given. Thus AB line for A & B points, RS line for R & S points].

31.3.4 Curved lines require some more help to identify. Thus PAQ, PBQ, PCQ, PDQ are curved lines between P & Q (in the figure of section 31.3.3).

You can draw these lines, freehand (i.e. using own skilled hands, like an artist) or you can use “FRENCH CURVES”. These are a set of funny shaped tools with neat, smooth edges. You can use these to draw PAQ, PDQ etc.

RES, RFS, RGS etc are complicated curved lines (some are like waves). To draw them you may have to use 2 or more French curves and different curved edges.

31.3.5 Activity:

A. Bring a set of french curves and let the students play with them.
B. Let each student draw sets of points AB (5 cm apart); PQ (10 cm) RS (15 cm). Let them draw all kinds of lines between the pairs of points.

31.4 How to write points:

31.4.1 Points: Many symbols are used:

- • Closed circle or bullet
- O Open circle
- ■ Closed square
- □ Open square
- ▲ Closed triangle
- △ Open triangle
- ✱ Star
- X Into symbol
- + Crosswire symbol
- ⊙ Concentric circle method / bullets eye
- ⊗ Closed cross
- ⊕ Closed crosswire

Use minimum size when length is important. Use suitable size when length points themselves (i.e. their location) is important.

31.4.2 Activity:

In maps, many conventions are used.

a. Students can see an atlas and see some.

b. Tourist maps have special attractive symbols.

31.5 How to read points:

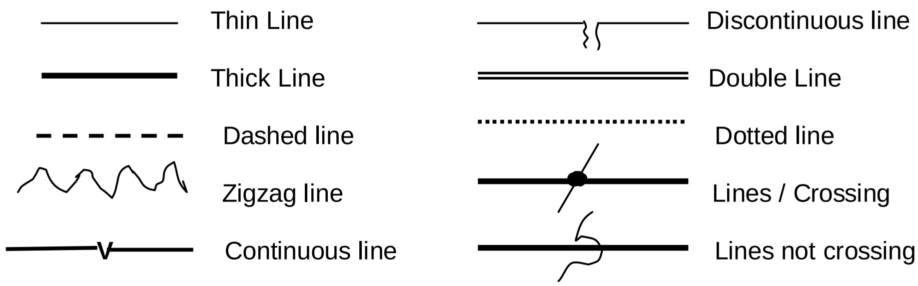
One point only P• ‘Point P’

Many Points A• B• C•

Points A, B, C or points A, B and C or point A, point B, point C (with ‘and’ if you want) or two point A and B or three points A, B and C etc.

31.6 How to write lines:

31.6.1 Kinds of lines



31.6.2 Activity:

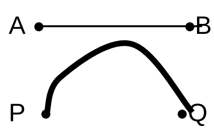
a. Take any map. See different lines given there. Eg: Railways, major roads, minor roads, airlines routes, sea routes etc (use a good atlas).

b. Take an electricity or electronics book. See the drawings there and discuss.

c. Take a few drawings (‘blue-prints”) from the draughtsman’s table and see how he has drawn the lines.

d. See a scale drawing from a civil engineer.

31.7 How to read lines:



Line AB, straight line AB.

Line PQ (in the figure); curved line PQ, Arc PQ

31.8 For Teachers:

[This section is for teachers and self learning students].

31.8.1 Geometry Box:

Many things we take for granted (i.e., we assume that we know – like how to eat or drink). One of these is how to use a geometry box, and each one of its contents. Some students may need help even in this simple thing. So there is an activity at the end of this chapter. Teachers should read that and decide whether his class needs it (to be told in the beginning itself).

31.8.2 How to measure distance:

Distance between 2 points is always the shortest distance between them i.e., the length of a straight line through them. Graduated scales are available only for that purpose. If the points are on paper you can draw the line and measure with a scale or use a divider and go to a scale. If the points are on a machine, instruments remote place etc use some types of calipers available.

Activity:

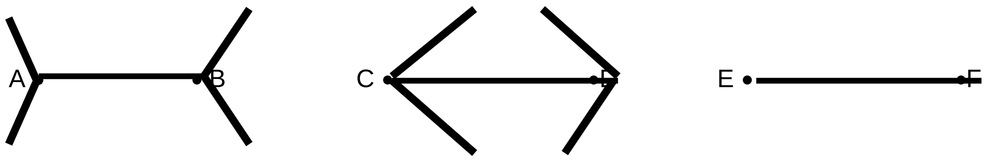
Teachers! Kindly take time to show and demonstrate dividers and calipers

31.9 Exercises:

a. Draw lines of length 2 cm; 4 cm; 6 cm.
b. Name the lines AB, PQ, XY.
c. Show 2 points A & B, 2 cm distant.
d. Indicate point p. Mark a point Q, which is 4 cm from point P.
e. The distance between 2 points X and Y is 6 cm. Show these points.
f. Let one student A draw a straight line and write down the length and keep it a secret. Student B should guess the length. If it is (within 20% or so) approximately OK, he can measure and verify.

31.10 Activity: (for fun)

a.



Let students produce this chart (secret AB = CD = EF). Let others guess.

b. Let some charts be AB really greater than CD; some others CD > AB > EF.

c.

Let the students produce charts and (illusions) like these measure PQ, RS.

d. Add you own ideas.

31.11 Exercises and Activities:

31.11.1 Exercises:

1. Draw a line XY. Measure the length both in inches and cm. Write
   Length = Inches = Cm =
2. Using (1) above find 1 inch = …. Cm
3. Let many students do (1) and (2) above.
4. Let the students (or teacher) collect all the results of (2) and make an average value.

31.11.2 Activities:

a. Go and learn from draughtsman how to draw thick lines, thin lines etc. learn how he draws parallel lines.
b. Use 2 setsquares and draw parallel lines passing through various points.
c. Take a fairly large map of India. Measure the distance between Delhi and your place (in cm). Use the scale given in the map to find actual distance.
d. Do (c) above in your own state.
e. Do (c) above in your own city.
f. Learn to measure curved distances using threads or flexible fine wires. Use this to find road or rail distances between 2 points in a map.

31.12 Angles

31.12.1 We saw that many points make a line and lines can be straight or curved.

a. Parallel lines: We have already learnt how to draw parallel lines. Now to define: Two straight lines, which will never meet, are parallel lines.

Activity:

Teacher can just allow students to actually see or simply imagine where there are parallel lines. Let them make a list.

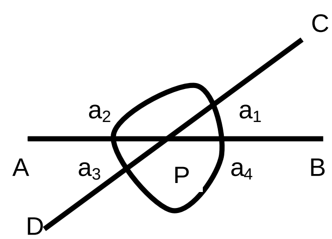
After list is made, cross check if the following items are mentioned: Railway lines, edges of tiles, book, notebooks, floor, ceiling, walls, lines in notebook paper, highway lanes.

b. Intersection: Two lines can cross (= cut) each other. It is called intersection. Two curved line can intersect at many points. Two straight lines can cut only at one point. This called point of intersection.

Activity:
Take two parallel threads; test their strength. Let them intersect at one point; test their strength. Let them interest at many points; test their strength. Go and see twisted ropes and guess why they are twisted. Eg: binding ropes, tug-of-war rope, steel ropes used in cranes, elevators, big machines.

31.12.2 Angles:

When two straight lines intersect, angles are seen. Angle can be understood as a tilt, in relation to another.



In this figure a_1, a_2, a_3, a_4 are the four angles made by the lines AB & CD intersecting at point P.

How to write: angle a1 is written as $\angle CPB$ or $\angle BPC$ (i.e., point of the angle in the middle). Some persons write $C\hat{P}B$ or $B\hat{P}C$.

Exercise:
Write the names of the other angles a_2, a_3, a_4

Types of Angles:

Right Angle: is the most important angle. Any worker should know this. Vertical means straight upwards. Horizontal means "straight down on the ground". The angle between true vertical and true horizontal is the right angle.

Activity:
Let all the students see or imagine right angle and show or name them. Make a list. After this list is made crosscheck if the following have come:
The English letter capital L, edge of a book or notebook, corners of tables, joint of floor and wall or wall and wall, standing at attention, fingers (shown as when we talk of right hand or left hand rule of Fleming in Physics) many joints. [More the messier]

Acute Angle: Any angle less than the right angle.
Obtuse Angle: Any angle bigger than the right angle.

Activity:
1. Indoors, working in Pairs. One person A slowly opens (then closes) a study notebook. Referee asks "stop" student B should say what is the angle [acute, obtuse or right].

2. Outdoors, all in line. Hand exercise (or red cross exercise). Referee says stop. What angle? (i.e., angle between the hand and the body i.e., trunk). If the student says the correct thing, referee can ask everyone to say in chorus. Eg: what angle? OK All

   How to measure angles: Angles are measured in degrees. i.e., unit of angle is degree.

[Caution: The same word is used to measure temperature also. Meaning must be understood according to context (= as per the situation, knowing where it comes].

[To the teachers: Radian as a measure of angle can wait until trigonometry comes].

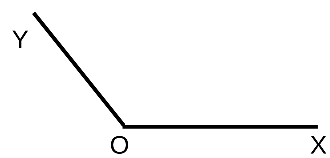
1 right angle = 90^o Acute angle = $<90^o$
2 right angle = 180^o Obtuse angle = $>90^o$

Angle Measure:

90^o

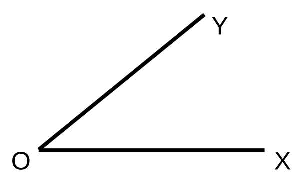
$\angle XOY = 90^o$

$>90^o$



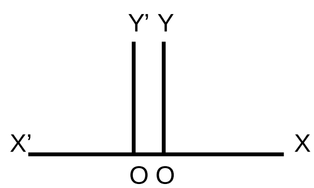
$\angle XOY > 90^o$

$<90^o$



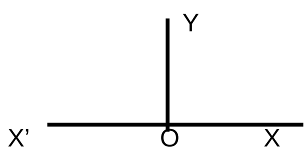
$\angle XOY < 90^o$

180^o



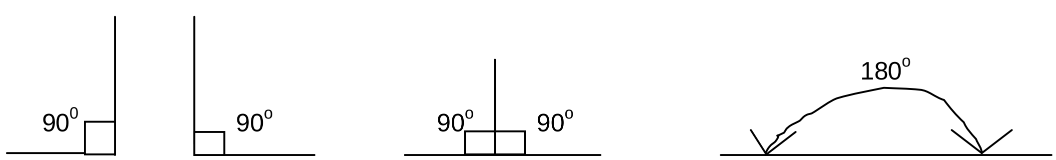
$\angle XOY + \angle X'OY'$

Same as



XOX' = 180^o

Rule: a horizontal line makes angle of 180 degree. A horizontal line and a vertical line make an angle of 90 degree



[For teachers: This elementary book has no use for terms like complementary and supplementary angles].

31.13 Areas:

Many points (dots) close together makes a line. If they stand touching, a horizontal line may be formed. If they sit on top of the other a vertical line may be formed. Imagine many lines close together. A total area may be formed.

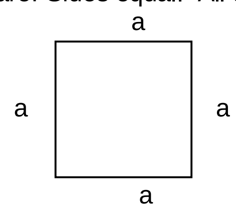
Another way of explaining an area is fencing. You make fence. If the fence goes around and returns to the original spot. You have covered an area.

In real life, areas come in all shapes and sizes. But when man makes, he likes to be neat and methodical. There geometry helps.

Activity:
Take a map of the world. Compare subdivisions of USA, Australia etc. Compare with other continents. Can we make a statement like this? “Natural boundaries are usually irregular (or curved lines). Man-made boundaries tend to be regular (or straight lines).

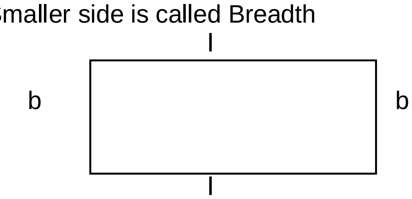
31.13.1 Some geometric figures:

1. Square: Sides equal. All angles are right angles.



Area A = a^2

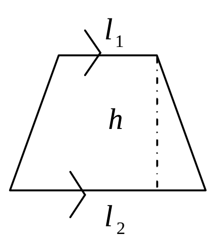
2. Rectangle: All angles right angles opposite sides equal. Longer side is called Length. Smaller side is called Breadth



Area = l x b

[For teachers! Sometimes it is easier for students to understand, if you explain some terms and their meanings. Here you can help. Word ‘length’ and ‘long’ are related. Word ‘breadth’ and ‘broad’ are related]

3. Trapezium: Two sides are parallel. Area = h x $\frac{l_1+l_2}{2}$



l_1, l_2 = Lengths of parallel sides.
h = vertical distance = height

Two other very important shapes are Triangle and Circle. These are very Important. So separate chapters.

31.14 Any four sided figure. The name given in maths books is Quadrilateral. This literally (= actually, in fact to the letter) means ‘Four – Sided’. So we can use when necessary, the term “Four Sided Figure”.

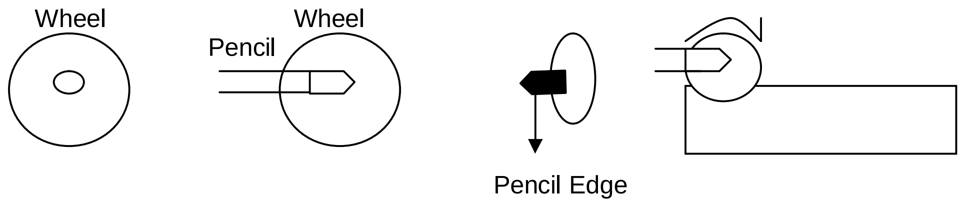
31.15 Many sided shapes. They are called polygon.
[Students! Learn this word. Higher studies require this. Poly means ‘many’ as in polytechnic, polygamy, polypeptides etc].

31.16 Activity:

a. (Identify the shape). Collect some sketches, photographs, building plans, elevations, some objects, nuts, cut plates, randomly cut cardboard etc.
Let the class identify. To make it interesting, take a piece and ask from a list: Is this a triangle? Is this a square? Is this a circle etc?

b. Extend the idea of (a) to objects around. Eg: cycle spokes, wheels, table, window.

c. Fun activity: Take a circular object with a small hole at the center. Eg: A metal washer, spool of a sewing machine. If you don't find one, make one. Fix a pencil tightly into it. Place this arrangement on a scale (or a thick straight-edge). Ask someone to roll it while you hold the pencil tightly. See what you get.

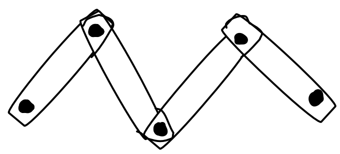


Now a third person holds a cardboard (or paper) touching the pencil's top.
Result: Did you get a straight line? Ok

d. In (c) above make a hole away from the circle. See what you get?
Result: Did you get a wavy pattern? Ok

e. (c) & (d) above can be done with a throw away CD disc also.

f. Get thrown-away ice cream spoons and wash them in soap & dettol water, dry them. Now make as shown. You have to carefully make holes and join at the ends. Play with angles.



31.17 Geometry box: [Teachers! Some students might not have been properly told about the various items and their correct uses. Even if some persons know, it is good to say them, though briefly].

1. Scale – to draw a line, to measure length (even $\frac{1}{16}$ of inch, 1 mm).
2. Setsquares – draw perpendicular (90^o angle) angles 45^o, 30^o, 60^o.
3. Protractor – draw / measure any angle from 0^o to 180^o – least is $½^o$.
4. Compass – with a pencil – to draw circles (arc = part of a circle).
5. Divider – To mark points, to accurately draw lengths, to "Lift" length.
6. Extras – Now a days template are also given along with the above items. At least there are 2 types LETTERS, GEOMETRIC FIGURES.
7. [Teachers can bring calipers and french curves, markers, metal markers, line markers and just mention where they are used].
8. Enterprizing teachers can include in (7) above plumbline and spirit level, mind rafter.

31.18 Exercises:

1. •Q

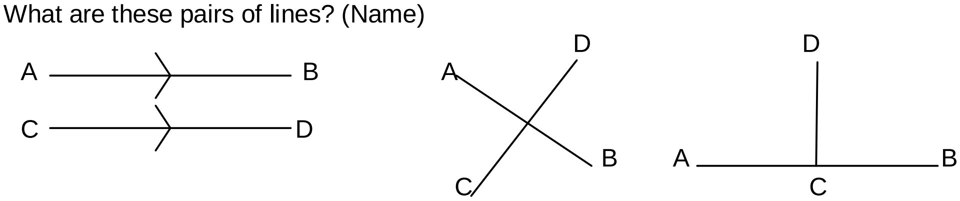
P• •R

•S

Students can make their own questions like this one.

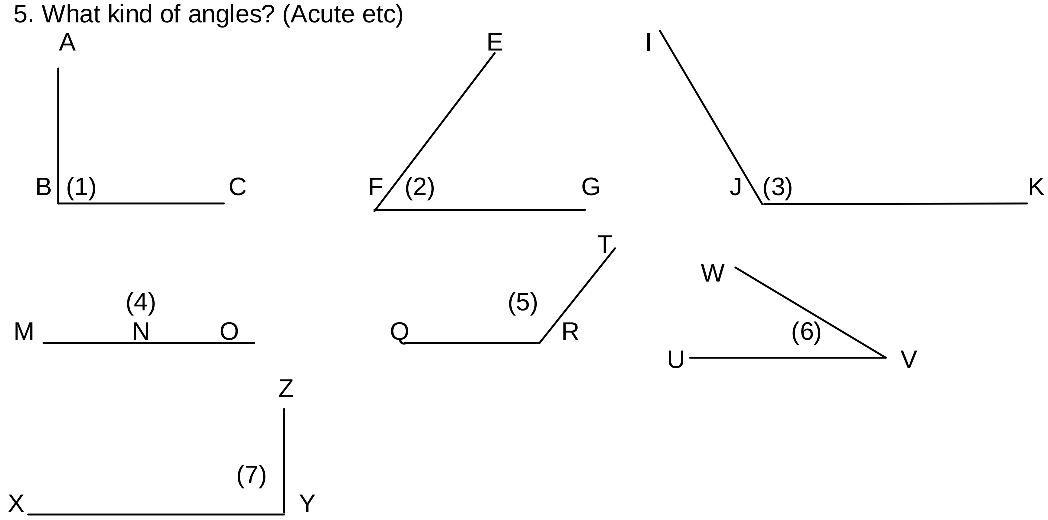
Guess the lengths PQ, PR, PS and write it down. Now measure and compare. Within 10% 2 marks, 20 % 1 marks, >20% zero.

2. How many lines can you draw (a) starting from a point (b) passing through a point?
3. What are these pairs of lines? (Name)



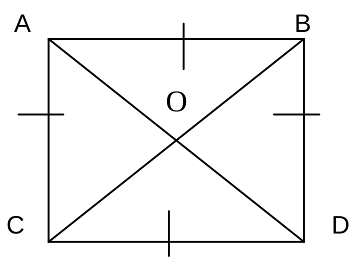
4. What kind of line? (Thick, dotted….)

5. What kind of angles? (Acute etc)



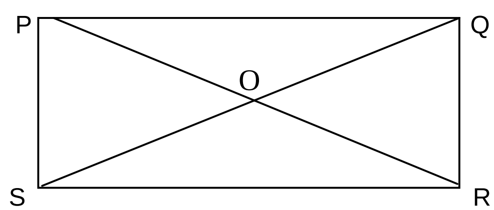
6. In equation 5 above – approximately, how many degrees? (Range is given).
Eg: 90^o - (1) 0 - 89^o = 90^o = 91 – 180^o =

7.



a. In this figure, how many angles are there? Choice….
Ans: (a) 4 (b) 8 (c) 12 (d) 16
[Note: 180^0 is not counted as angle]
b. How many right angles?
c. How many acute angles?

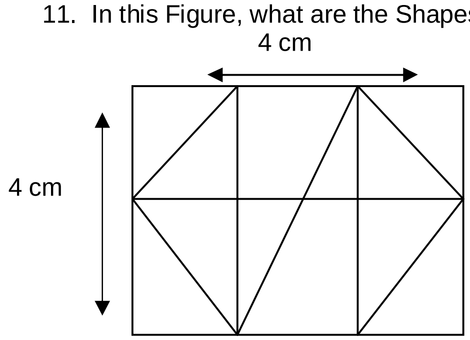
8. Same as (7) but rectangle



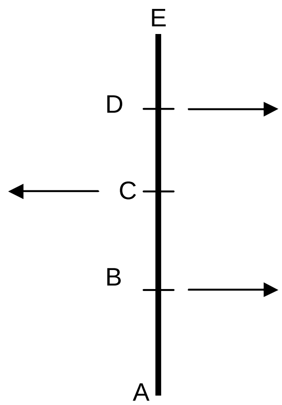
9. Draw a line (any length) AB. At point A draw a line making 60^o with AB. At point B draw a line making 60 with AB. Let intersection point B. What did you get? Measure lengths CA and CB. Measure AB. What do you see? Measure angle at C, i.e., $\angle ACB = ?$

10. Draw the figures of (a) Rectangle (b) Square (c) Rhombus (d) Trapezium (e) Circle (free hand drawing).

11. In this Figure, what are the Shapes do you see? How many each?



12.

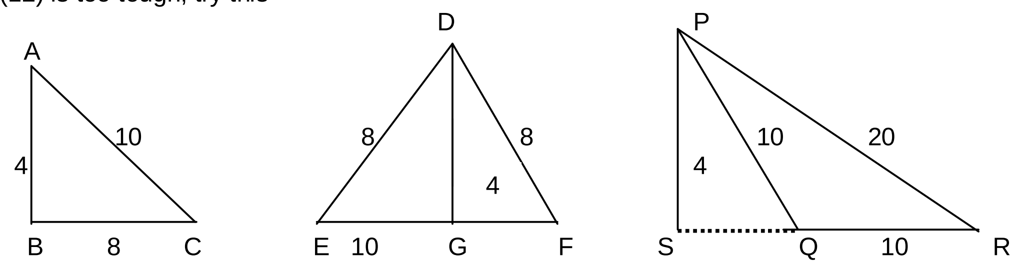


A to E continuous measure B 100, C 200, D 300, E 400.

F at B 100
G at D 200
H at C 300 (all in meters)

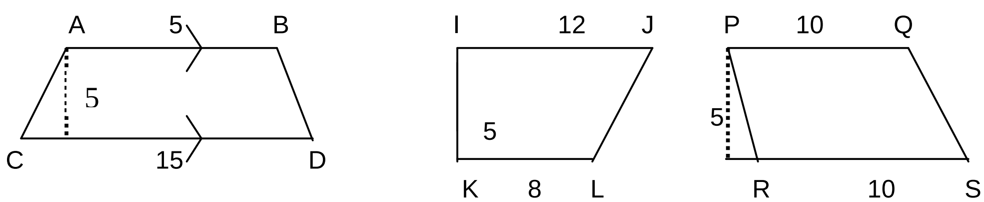
Complete the figure and find the total area in Sq. m.

13. If (12) is too tough, try this

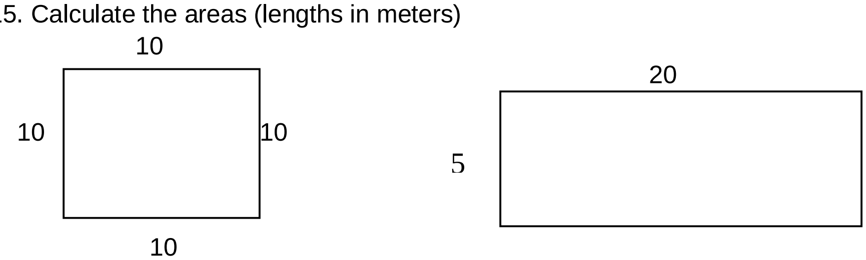


Calculate the areas of ABC, DEF & PQR.

14. Calculate the areas (length are given)



15. Calculate the areas (lengths in meters)



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Chapter - 32 Squares and Area

32. Activity:
Allow the students to consult an English dictionary. Let them write down the meanings of '**square**' first; and then '**cube**'.

32.1 We have already seen in algebra.
If $x = 4$
$x^2 = x \times x$
$= 4 \times 4$
$= 16$

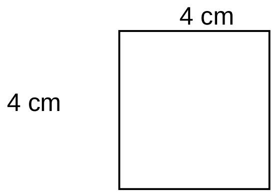
One thing	Same thing	$\cdots^2$

X =

Multiply something by itself or write down twice and multiply

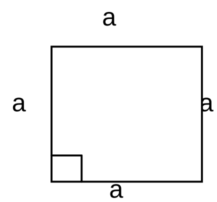
We will not discuss whether algebra used the word first or borrowed it from geometry. We will just appreciate and understand that there is close relationship.

32.2



The name of this shape is **SQUARE**.
Area of the square = 4 x 4 = 16 Sq. cm
(**Sq. cm = Square Centimeter**)

In general Area = a^2



If a is in **cm**, area is in **sq. cm**
If a is in **m**, area is in **sq. m**
If a is in **foot**, area is in **sq. ft**
If a is in **km**, area is in **sq. km**
If a is in **miles**, area is in **sq. miles**

32.3 Graph sheets – Activity:

A. Teachers, show graph sheets.
Let students count bigger squares, smaller squares etc.
Let them verify the formula of 32.2

B. Bring inch graph sheets and bring cm graph sheets. Cut cm graph sheet to fill into 1 inch X 1 inch square on inch graph. Count now the number of cm squares (count small squares). Fill up:

$\therefore$ 1 $(\text{inch})^2$ = ……. $(\text{cm})^2$

32.4 Aid for approximation: Make a list of squares.

x	x^2
1	1
2	4
3	9
4	16
5	25
6	36
7	49
8	64
9	81

x	x^2
10	100
20	400
30	900
40	1600
50	2500
60	3600
70	4900
80	6400
90	8100

Students, please note that the first list must be memorized.
Did you see that the second list can be generated from the first?

Exercise:

Example: $\sqrt{400}$ =? $\sqrt{4}$ = 2 $\sqrt{100}$ = 10; $\sqrt{400}$ = 2 x 10

$\sqrt{4000}$ =? This is not easy. This cannot be done by $\sqrt{4}$ $\sqrt{1000}$. Instead make it $\sqrt{100}$ x $\sqrt{40}$ = 10 $\sqrt{40}$. 6^2 = 36, 7^2 = 49 (see from list1). Therefore $\sqrt{40}$ is >6 and <7 say 6.5. Therefore $\sqrt{4000}$ $\approx$ 10 x 6.5 $\approx$ 65.

Find the approximation:

a. $\sqrt{3}$	b. $\sqrt{5}$	c. $\sqrt{7}$	d. $\sqrt{13}$	e. $\sqrt{90}$
f. $\sqrt{300}$	g. $\sqrt{500}$	h. $\sqrt{700}$	i. $\sqrt{1300}$	j. $\sqrt{900}$
k. $\sqrt{3000}$	l. $\sqrt{5000}$	m. $\sqrt{7000}$	n. $\sqrt{130}$	o. $\sqrt{9000}$

32.5 Rectangles:

Area A = l x b
= Length x breadth

Properties of rectangles:

1. Opposite sides are parallel.
2. Opposite sides are equal (in length).
3. All the four angles are right angles.

Area formula we have seen earlier

32.6 Practical situations: Activity

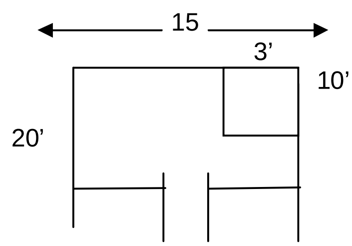
Measurement of area is very important in many fields. In day-to-day life, let the students list down instances. After allowing the students to make the list teacher can check whether at least the following have come in:

a. House site
b. Town area
c. Fields in areas
d. Room sizes
e. Painting surfaces
f. Carpentry
g. Cloth, textile

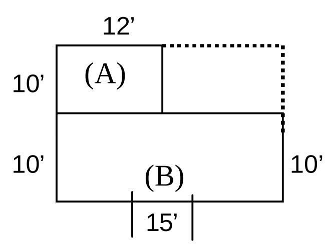
For most of the items discussed in 32.5 above, area can be measured or calculated, based on paper map or plan. These are called scale drawings.

Example:

A. Room plan is given. A small area is left for attached bathroom. Dimensions are given to scale. Room's ground area is to be tile. Tile cost is 50 rupees per sq. ft (including all work). Calculate the cost.



Areas:



Area A = 10' x 12' = 120 Sq. ft
Area B = 10' x 15' = 150 Sq. ft

Total Area = 270 Sq. ft

Cost / Sq. Ft = Rs. 50
Total cost of tiling = 270 x 50 = 13,500

Exercises:

1. In the example (A) given above, calculate the cost for bathroom also.

2. In (1) above, for 5' height all round, walls are tiled. Tile cost is 20 Rs / Sq. ft. Calculate the cost?
3. All the inner walls except the bathroom are to be painted. Room height is 10 ft. Contractor takes Rs. 150 / sq. ft. Calculate the cost of painting? [Clue: Forget ceiling; assume doors also as area (over estimate is ok).

Graphical Method: Area

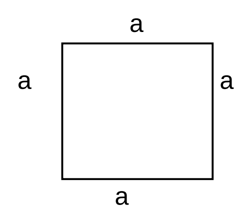
Activity:

For any shape, regular or irregular, graph sheet method is easy & versatile. Counting of small (millimeter) squares (if the size in centimeters). Count Cm square if the shape is very large. This method is very useful to actively involve students in verifying the different formulas. Let some other students do as above for squares, rectangles, rhombuses, trapezium any four sided figure. Some other do for various sized circles.

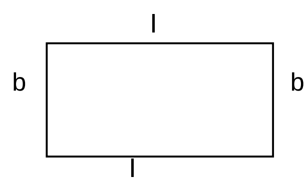
For irregular shapes, drawing on the graph sheet helps. (Scale drawing is an art worth learning. Students of any discipline can learn this. It is quite useful).

32.7 Perimeter (Also called circumference):

32.7.1



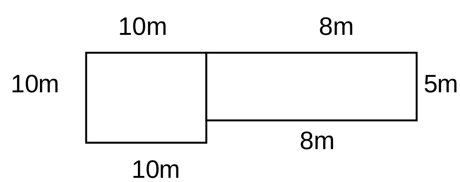
Perimeter of a Square = 4a



Perimeter of a rectangle = l +b +l +b
= 2 (l +b)

32.7.2 Exercises:

A. Find the perimeter of a square of side 10 meters?
B. Find the perimeter of a rectangle of sides 5 m and 8 m?
C. In (A) & (B) above, assume these are sites (for house). Steel fencing is to be done. Fence cost is quoted by contractor as Rs. 50 per running meter. What are the costs of fencing for (A) and (B)?
D. What is the cost if the site was as given: [Clue – one fence in overlapping boundary is enough].



32.8 Exercises:

A**.** A site has an area of 2500 sq. ft. It is square shaped. Draw the map. (Show lengths).
B. In (1) above area is only 2400 sq. ft. One side measured was 40 ft and the shape is a good rectangle. Draw the map.
C. In (1) & (2) above calculate the cost of fencing [Rs. 20 per running foot].
D. Do (1) & (2) in meters.
E. Suggest a simple method of finding the perimeter of irregular shapes. [Clue: Go back to 31.11.2 (f) and see how one can use thread of wires].

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Chapter - 33 Triangles

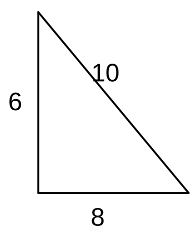
33.1 Its name itself is descriptive. Funny thing is it is called 'Trilateral' (or trisides) in many of (= Indian) languages. Liberally meaning 'a figure haying 3 angles' or in the other 'a figure having 3 sides'. This statement is true of any polygon. Properties of a triangle:

a. 3 sides
b. 3 angles
c. Sum of 3 angles = 180^0
d. Sum of 2 sides always > third side.
e. Area = ½ x b x h
Where b = base
h = height

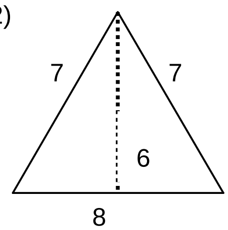
33.2 Exercises

a. Calculate the areas of triangle:

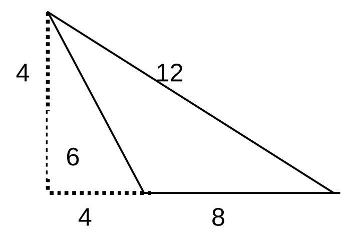
(a1)



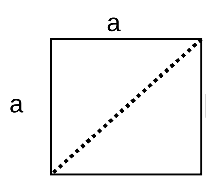
(a2)



(a3)



b. Using formulas show that the area of a square = a2

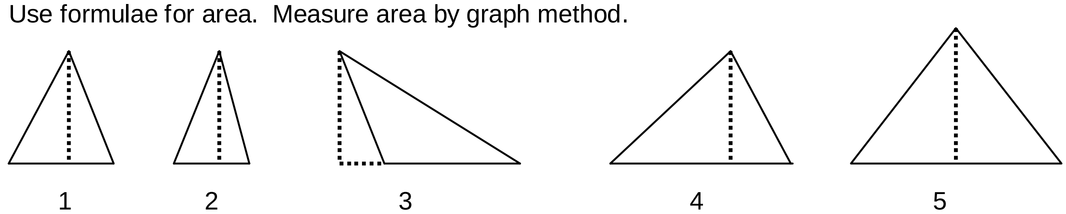


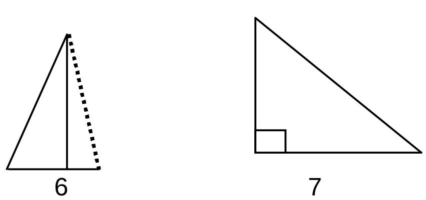
[Clue: Make into 2 triangles]

c. Same as (b) but rectangle area = l x b. [Clue: Use only area of triangle formula].
d. Do the same as (c) for a Trapezium.

33.3 Activity: Area of Triangles:

Let the students take different shapes and sizes of triangles. Measure the base and height. Use formulae for area. Measure area by graph method.





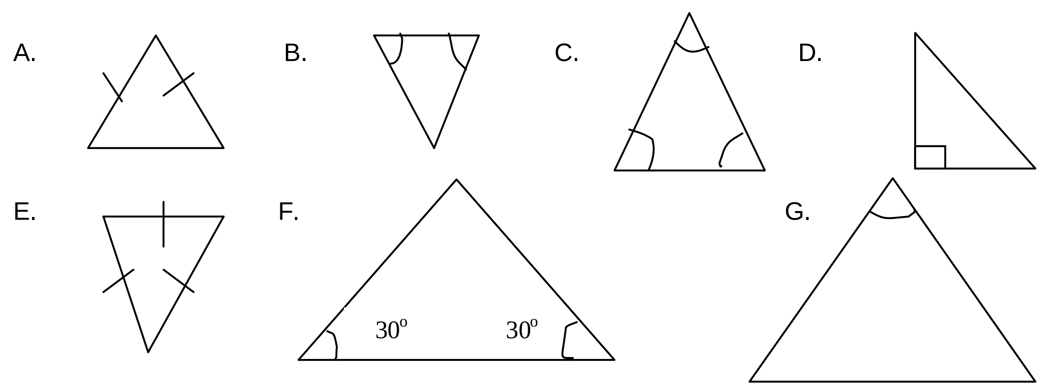
S. No	Base cm	Height cm	Area by formula	Count of small squares	Area by graph
1					
2					
3					
4					
5					
6					
7					

33.4 Types of triangles:

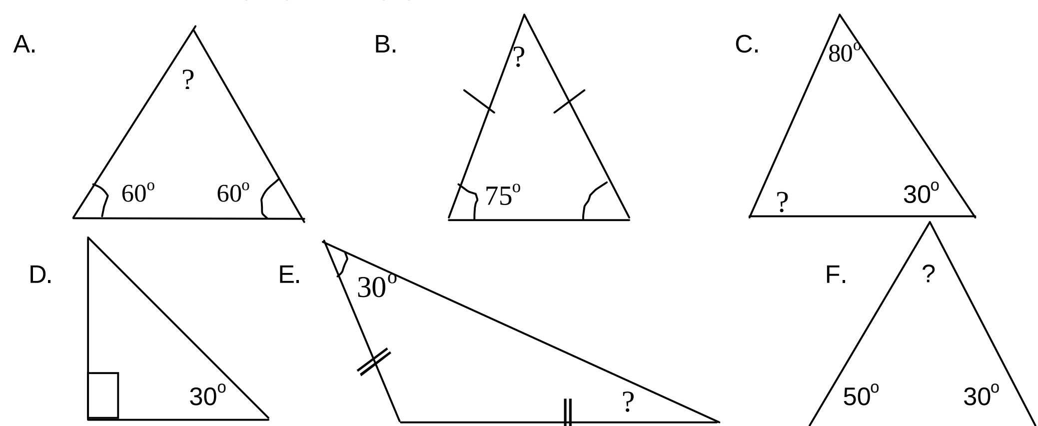
Equilateral - All sides equal, ∴ all angles equal, ∴ each angle = 60^o
Isosceles – 2 sides equal, ∴ 2 angles equal
Right angled – one angle is 90^o, ∴ special properties.
Acute angled – All angles are less than 90o. [∴ equilateral, isosceles are all in this].
Obtuse angled – one angle is > 90^o
Scalene triangle – Any ordinary triangle

Exercises:

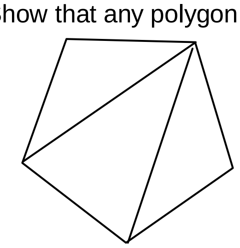
I. Name these triangles (i.e., say to which category each one belongs):



II. Find the third angle (shown by?)



III. Show that any polygon can be divided into triangles. Worked examples:



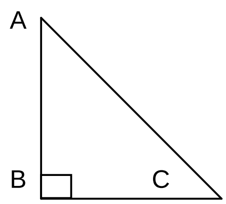
Pentagon = 5 sided figure
Number of triangles = 5 – 2 = 3

A. Quadrilateral B. Hexagon (Hexa = Six) C. Octagon (Octa= 8)

33.5 Right angled triangle:
This is very special. It is seen in every practical situation.

Pythagoras theorem says, if you know 2 sides of a right angled triangle, you can calculate and find out the third one.

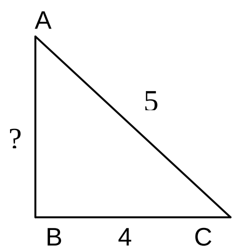
Thus



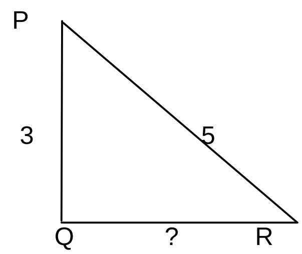
AC2 = AB2 + BC2
(AC is the longest side, of course)

Exercises:

1. 2 sides of a right angled triangle (rat) are 3 cm and 4 cm. Calculate the third?

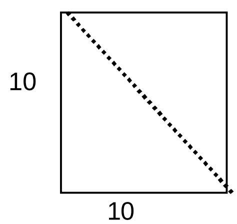


AB =?



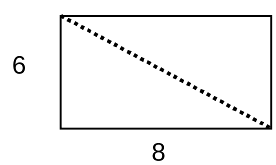
QR =?

2.



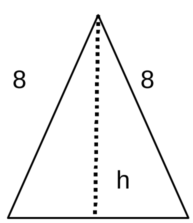
Calculate the diagonal of the square?
Calculate the other diagonal also? Are they equal?

3.



Calculate the diagonal of the rectangle?
Calculate the other diagonal also?
Are they equal?

4.



Calculate the height h.
Then calculate the area of triangle.