

**Basic Mathematics (241)**  
**Marking Scheme**  
**2023-24**

**Section A**

1) $xy^2$	1
2) 20	1
3) $\frac{1}{2}$	1
4) No Solution	1
5) 0,8	1
6) 5 Unit	1
7) $\Delta PQR \sim \Delta CAB$	1
8) RHS	1
9) $70^\circ$	1
10) $\frac{3}{4}$	1
11) $45^\circ$	1
12) $\sin^2 A$	1
13) $\pi : 2$	1
14) 7 cm	1
15) $\frac{1}{6}$	1
16) 15	1
17) 3.5 CM	1
18) 12-18	1
19) Both assertion and reason are true and reason is the correct explanation of assertion.	1
20) Assertion (A) is false but reason(R) is true.	1

## SECTION B

21)  $3x+2y = 8$

$6x-4y = 9$

$a_1=3, a_2=6, C_1=8$

$b_1=2, b_2=-4, C_2=9$

$\frac{a_1}{a_2} = \frac{3}{6} = \frac{1}{2} \quad \frac{b_1}{b_2} = \frac{2}{-4} = \frac{-1}{2} \quad \frac{c_1}{c_2} = \frac{8}{9}$

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

The given pair of lines is consistent.

1

1/2

1/2

22) Given:-  $AB \parallel CD \parallel EF$

To prove:-  $\frac{AB}{ED} = \frac{BF}{FC}$

Constant:- Join BD which intersect EF at G.

Proof:- in  $\triangle ABD$

$EG \parallel AB$  ( $EF \parallel AB$ )

$\frac{AE}{ED} = \frac{BG}{GD}$  (by BPT) \_\_\_\_\_ (1)

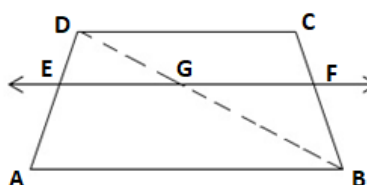
In  $\triangle DBC$

$GF \parallel CD$  ( $EF \parallel CD$ )

$\frac{BF}{FC} = \frac{BG}{GD}$  (by BPT) \_\_\_\_\_ (2)

from (1) & (2)

$\frac{AE}{ED} = \frac{BF}{FC}$



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OR

Given  $AD=6\text{cm}, DB=9\text{cm}$

$AE=8\text{cm}, EC=12\text{cm}, \angle ADE=48^\circ$

To find:-  $\angle ABC=?$

Proof:

In  $\triangle ABC$

Consider,  $\frac{AD}{DB} = \frac{AE}{EC}$

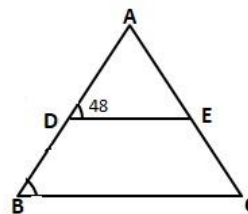
$\frac{6}{9} = \frac{8}{12}$

$\frac{2}{3} = \frac{2}{3}$

$\frac{AD}{DB} = \frac{AE}{EC}$

$DE \parallel BC$  (Converse of BPT)

$\angle ADE = \angle ABC$  (Corresponding angles)  $\angle ABC = 48^\circ$



1

1

23) In  $\Delta OTA$ ,  $\angle OTA = 90^\circ$

By Pythagoras theorem

$$OA^2 = OT^2 + AT^2$$

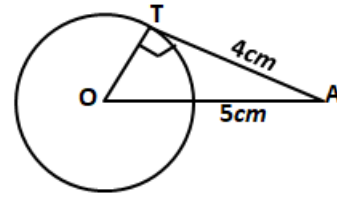
$$(5)^2 = OT^2 + (4)^2$$

$$25 - 16 = OT^2$$

$$9 = OT^2$$

$$OT = 3 \text{ cm}$$

radius of circle = 3 cm.



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1

24)  $\sin^2 60^\circ + 2 \tan 45^\circ - \cos^2 30^\circ$

$$= \left(\frac{\sqrt{3}}{2}\right)^2 + 2(1) - \left(\frac{\sqrt{3}}{2}\right)^2$$

$$= \frac{3}{4} + 2 - \frac{3}{4}$$

$$= 2$$

1

1

25) Area of the circle = sum of areas of 2 circles

$$\pi R^2 = \pi(40)^2 + \pi(9)^2$$

$$\pi R^2 = \pi \times (40^2 + 9^2)$$

$$R^2 = 1600 + 81$$

$$R^2 = 1681$$

$$R = 41 \text{ cm.}$$

$$\text{Diameter of given circle} = 41 \times 2 = 82 \text{ cm}$$

1/2

1/2

1/2

1/2

OR

r of circle = 10 cm  $\theta = 90^\circ$

$$\text{A of minor segment} = \frac{\theta}{360^\circ} \pi r^2 - \text{A of } \Delta$$

$$= \frac{\theta}{360^\circ} \times \pi r^2 - \frac{1}{2} \times b \times h$$

$$= \frac{90^\circ}{360^\circ} \times 3.14 \times 10 \times 10 - \frac{1}{2} \times 10 \times 10$$

$$= \frac{314}{4} - 50$$

$$= 78.5 - 50 = 28.5 \text{ cm}^2$$

$$\text{A of segment} = 28.5 \text{ cm}^2$$

1/2

1/2

1/2

1/2

## Section C

26) Let  $\sqrt{3}$  be a rational number

$$\sqrt{3} = \frac{a}{b} \quad \text{where } a \text{ and } b \text{ are co-prime.}$$

1

squaring on both the sides

$$(\sqrt{3})^2 = \left(\frac{a}{b}\right)^2$$

1/2

$$3 = \frac{a^2}{b^2} = a^2 = 3b^2$$

$a^2$  is divisible by 3 so  $a$  is also divisible by 3 \_\_\_\_\_ (1)

let  $a=3c$  for any integer  $c$ .

$$(3c)^2 = 3b^2$$

1/2

$$ac^2 = 3b^2$$

$$b^2 = 3c^2$$

since  $b^2$  is divisible by 3 so,  $b$  is also divisible by 3 \_\_\_\_\_ (2)

From (1) & (2) we can say that 3 is a factor of  $a$  and  $b$

1/2

which is contradicting the fact that  $a$  and  $b$  are co-primes.

Thus, our assumption that  $\sqrt{3}$  is a rational number is wrong.

Hence,  $\sqrt{3}$  is an irrational number.

1/2

27)  $P(S) = 4S^2 - 4S + 1$

$$4S^2 - 2S - 2S + 1 = 0$$

$$2S(2S-1) - 1(2S-1) = 0$$

$$(2S-1)(2S-1) = 0$$

$$S = \frac{1}{2} \quad S = \frac{1}{2}$$

1

$$a = 4 \quad b = -4 \quad c = 1 \quad \alpha = \frac{1}{2} \quad \beta = \frac{1}{2}$$

$$\alpha + \beta = \frac{-b}{a} \quad \alpha \beta = \frac{c}{a}$$

$$\frac{1}{2} + \frac{1}{2} = \frac{-(-4)}{4} \quad \left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = \frac{1}{4}$$

1

$$\frac{1+1}{2} = \frac{+4}{4} \quad \frac{1}{4} = \frac{1}{4}$$

$$\frac{2}{2} = 1$$

1

$$1 = 1$$

28) Let cost of one bat be Rs  $x$

Let cost of one ball be Rs  $y$

1/2

ATQ

$$4x + 1y = 2050 \quad (1)$$

$$3x + 2y = 1600 \quad (2)$$

from (1)  $4x + 1y = 2050$

1/2

$$y = 2050 - 4x$$

1/2

Substitute value of  $y$  in (2)

$$[3x + 2(2050 - 4x) = 1600]$$

$$3x + 4100 - 8x = 1600$$

$$-5x = -2500$$

$$x = 500$$

1/2

Substitute value of  $x$  in (1)

$$4x + 1y = 2050$$

$$4(500) + y = 2050$$

$$2000 + y = 2050$$

$$y = 50$$

1/2

Hence

Cost of one bat = Rs 500

1/2

Cost of one ball = Rs 50

**OR**

Let the fixed charge for first 3 days = Rs  $x$

And additional charge after 3 days = RS  $y$

1/2

ATQ

$$x + 4y = 27 \quad (1)$$

$$x + 2y = 21 \quad (2)$$

1/2

Subtract eq<sup>n</sup> (2) from (1)

$$x + 4y = 27$$

$$x + 2y = 21$$

$$2y = 6$$

$$y = 3$$

1

Substitute value of  $y$  in (2)

$$x + 2y = 21$$

$$x + 2(3) = 21$$

$$x = 21 - 6$$

$$x = 15$$

1

Fixed charge = RS 15

Additional charge = Rs 3

29) Given circle touching sides of ABCD at P, Q, R and S

To prove-  $AB + CD = AD + DA$

Proof-

$$AP = AS \quad (1) \quad \text{tangents from same point}$$

$$PB = BQ \quad (2) \quad \text{to a circle are equal in length}$$

$$DR = DS \quad (3)$$

$$CR = CQ \quad (4)$$

Adding eq<sup>n</sup> (1), (2), (3) & (4)

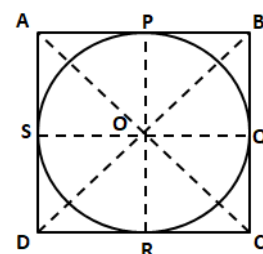
$$AP + BP + DR + CR = AS + DS + BQ + CQ$$

$$AB + DC = AD + BC$$

1

1

1



$$30) (\operatorname{cosec}\theta - \cot\theta) = \frac{1-\cos\theta}{1+\cos\theta}$$

$$\text{LHS} = (\operatorname{cosec}\theta - \cot\theta)^2$$

$$= \left( \frac{1}{\sin\theta} - \frac{\cos\theta}{\sin\theta} \right)^2 \quad 1/2$$

$$= \left( \frac{1-\cos\theta}{\sin\theta} \right)^2 \quad 1/2$$

$$= \frac{(1-\cos\theta)^2}{\sin^2\theta}$$

$$= \frac{(1-\cos\theta)^2}{1-\cos^2\theta} \quad 1$$

$$= \frac{(1-\cos\theta)^2}{(1-\cos\theta)(1+\cos\theta)}$$

$$= \frac{1-\cos\theta}{1+\cos\theta} \quad 1$$

$$\text{LHS} = \text{RHS}$$

OR

$$\operatorname{Sec}A (1 - \sin A)(\sec A + \tan A) = 1$$

$$\text{LHS} = \frac{1}{\cos A} (1 - \sin A) \left( \frac{1}{\cos A} + \frac{\sin A}{\cos A} \right) \quad 1$$

$$= \frac{(1-\sin A)(1+\sin A)}{\cos A \cos A}$$

$$= \frac{(1-\sin A)(1+\sin A)}{\cos^2 A}$$

$$= \frac{1-\sin^2 A}{\cos^2 A} \quad (1-\sin^2 A = \cos^2 A) \quad 1$$

$$= \frac{\cos^2 A}{\cos^2 A}$$

$$= 1 \quad 1$$

$$\text{LHS} = \text{RHS}$$

31) Red color balls = 6

Black color balls = 4

Total ball = 10

$$P(S) = \frac{\text{favourable out comes}}{\text{total no of out comes}} \quad 1/2$$

$$P(\text{Red}) = \frac{6}{10} = \frac{3}{5} \quad 1$$

$$P(\text{Not Red}) = 1 - \frac{3}{5} = \frac{5-3}{5} = \frac{2}{5} \quad 1$$

### Section D

32) Let the speed of train be  $x$  km/hr

distance = 360 km

$$\text{Speed} = \frac{\text{distance}}{\text{time}} \quad 1/2$$

$$\text{Time} = \frac{360}{x} \quad 1/2$$

$$\text{New speed} = (x + 5) \text{ km/hr}$$

$$\text{Time} = \frac{D}{S}$$

$$x + 5 = \frac{360}{\left(\frac{360}{x} - 1\right)} \quad 1$$

$$(x + 5) \left( \frac{360}{x} - 1 \right) = 360$$

$$(x + 5)(360 - x) = 360x$$

$$-x^2 - 5x + 1800 = 0$$

$$x^2 + 5x - 1800 = 0 \quad 1$$

$$x^2 + 45x - 40x - 1800 = 0$$

$$x(x + 45) - 40(x + 45) = 0$$

$$(x + 45)(x - 40) = 0 \quad 1$$

$$x + 45 = 0 \quad x - 40 = 0$$

$$x = -45 \quad x = 40$$

Speed cannot be negative

$$\text{Speed of train} = 40 \text{ km/hr} \quad 1$$

**OR**

$$\text{Let the speed of the stream} = x \text{ km/hr} \quad 1/2$$

$$\text{Speed of boat} = 18 \text{ km/hr}$$

$$\text{Upstream speed} = (18 - x) \text{ km/hr}$$

$$\text{Downstream speed} = (18 + x) \text{ km/hr} \quad 1/2$$

$$\text{Time taken (upstream)} = \frac{24}{(18-x)}$$

$$\text{Time taken (downstream)} = \frac{24}{(18+x)}$$

ATQ

$$\frac{24}{(18-x)} = \frac{24}{(18+x)} + 1 \quad 1$$

$$\frac{24}{(18-x)} - \frac{24}{(18+x)} = 1$$

$$24(18 + x) - 24(18 - x) = (18 - x)(18 + x)$$

$$24(18 + x - 18 + x) = (18)^2 - x^2$$

$$24(2x) = 324 - x^2$$

$$48x - 324 + x^2 = 0$$

$$x^2 + 48x - 324 = 0 \quad 1$$

$$x^2 - 6x + 54x - 324 = 0$$

$$x(x - 6) + 54(x - 6) = 0$$

$$(x - 6)(x + 54) = 0 \quad 1$$

$$x - 6 = 0 \quad x + 54 = 0$$

$$x = 6 \qquad x = -54$$

Speed cannot be negative

Speed of stream = 6 km/hr

1

33) Given  $\triangle ABC = DE \parallel BC$

To prove  $\frac{AD}{DB} = \frac{AE}{EC}$

Construction: join BE and CD

Draw  $DM \perp AC$  and  $EN \perp CD$

Proof: or  $\triangle ABC = \frac{1}{2} \times b \times h$

$$= \frac{1}{2} \times AD \times EN \text{-----(1)}$$

$$\text{Or } \triangle ABC = \frac{1}{2} \times DB \times EN \text{-----(2)}$$

Divide eq<sup>n</sup> (1) by (2)

$$\frac{\text{Or } \triangle ABC}{\text{Or } \triangle BDE} = \frac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times DB \times EN} = \frac{AD}{DB} \text{-----(A)}$$

$$\text{Or } \triangle ABC = \frac{1}{2} \times AE \times DM \text{-----(3)}$$

$$\text{Or } \triangle DEC = \frac{1}{2} \times EC \times DM \text{-----(4)}$$

Divide eq<sup>n</sup> (3) by (4)

$$\frac{\text{Or } \triangle ADE}{\text{Or } \triangle DEC} = \frac{\frac{1}{2} \times AE \times DM}{\frac{1}{2} \times EC \times DM} = \frac{AE}{EC} \text{-----(A)}$$

$\triangle BDE$  and  $\triangle DEC$  are on the same as DE and between name parallel lines BC and DE

– or  $(BDE) = \text{or } (DEC)$

hence

$$\frac{\text{ar } \triangle ADE}{\text{ar } \triangle BDE} = \frac{\text{ar } \triangle ADE}{\text{ar } \triangle DEC}$$

$$\frac{AD}{DB} = \frac{AE}{EC} \qquad \text{( from (A) and (B))}$$

Given

$$\frac{PS}{PQ} = \frac{PT}{TR}$$

$$\angle PST = \angle PRQ$$

To prove :- PQR is an isosceles  $\triangle$

Proof :-  $\frac{PS}{PQ} = \frac{PT}{TR}$

$$\angle PST = \angle PRQ \quad \text{(Corresponding angles)}$$

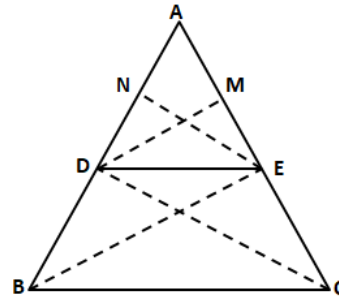
$$\text{But } \angle PST = \angle PRQ$$

$$\angle PQR = \angle PRQ$$

PR = PQ ( sides opposite to equal angles are equal

-  $\triangle PQR$  is isosceles  $\triangle$ .

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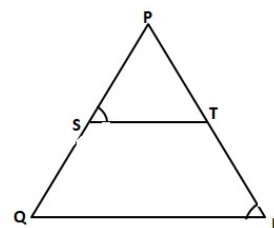


1

1

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1



1



34) Diameter of cylinder and hemisphere = 5mm radius ( $r$ ) =  $\frac{5}{2}$

Total weight = 14mm

Height of cylinder = 14 - 5 = 9mm

1

CSA of cylinder =  $2\pi rh$

$$= 2 \times \frac{22}{7} \times \frac{5}{2} \times 9$$

$$= \frac{990}{7} \text{ mm}^2$$

1

CSA of hemispheres =  $2\pi r^2$

$$= 2 \times \frac{22}{7} \times \left(\frac{5}{2}\right)^2$$

$$= \frac{275}{7} \text{ mm}^2$$

1

CSA of 2 hemispheres =  $2 \times \frac{275}{7}$

$$= \frac{550}{7} \text{ mm}^2$$

1

Total area of capsule =  $\frac{990}{7} + \frac{550}{7}$

$$= \frac{1540}{7}$$

$$= 220 \text{ mm}^2$$

1

**OR**

Diameter of cylinder = 2.8 cm

$r$  of cylinder =  $\frac{2.8}{2} = 1.4$  cm

$r$  of cylinder =  $r$  of hemisphere = 1.4 cm

Height of cylinder = 5 - 2.8

1

= 2.2 cm

Volume of 1 gulab jamun = vol. of cylinder + 2 x vol. of hemisphere

$$= \pi r^2 h + 2 \times \frac{2}{3} \pi r^3$$

1

$$\frac{22}{7} \times (1.4)^2 \times 2.2 + 2 \times \frac{2}{3} \times \frac{22}{7} \times (1.4)^3$$

$$= 13.55 + 11.50$$

$$= 25.05 \text{ cm}^3$$

1

volume of 45 gulab jamun = 45 x 25.05

syrup in 45 jamun = 30% x 45 x 25.05

$$= \frac{30}{100} \times 45 \times 25.05$$

1

$$= 338.185 \text{ cm}^3$$

$$= 338 \text{ cm}^3$$

1

35)

Life time (in hours)	Number of lamps	Mid x	d	fd
1500-2000	14	1750	-1500	-21000
2000-2500	56	2250	-1000	-56000
2500-3000	60	2750	-500	-30000
3000-3500	86	3250	0	0
3500-4000	74	3750	500	37000
4000-4500	62	4250	1000	62000
4500-5000	48	4750	1500	72000
	400			64000

2

$$\text{Mean} = a + \frac{\Sigma fd}{\Sigma f}$$

1/2

$$a = 3250$$

1/2

$$\text{Mean} = 3250 + \frac{64000}{400}$$

1

$$= 3250 + 160$$

$$= 3410$$

Average life of lamp is 3410 hr

1

### Section E

36)  $a_6 = 16000$      $a_9 = 22600$

$$a + 5d = 16000 \text{-----(1)}$$

$$a = 16000 - 5d$$

$$a + 8d = 22600 \text{-----(2)}$$

substitute in (2)

$$16000 - 5d + 8d = 22600$$

$$3d = 22600 - 16000$$

$$3d = 6600$$

$$d = \frac{6600}{3} = 2200$$

$$a = 16000 - 5(2200)$$

$$a = 16000 - 11000$$

$$a = 5000$$

$$(i) a_n = 29200 \quad a = 5000 \quad d = 2200$$

$$a_n = a + (n-1)d$$

$$29200 = 5000 + (n-1)2200$$

$$29200 - 5000 = 2200n - 2200$$

$$24200 + 2200 = 2200n$$

$$26400 = 2200n$$

$$n = \frac{264}{22}$$

$$n = 12$$

in 12<sup>th</sup> year the production was Rs 29200

$$(ii) n=8, \quad a=5000, \quad b=2200$$

$$a_n = a + (n-1)d$$

$$= 5000 + (8-1)2200$$

$$= 5000 + 7 \times 2200$$

$$= 5000 + 15400$$

$$= 20400$$

The production during 8<sup>th</sup> year is = 20400

**OR**

$$n = 3, \quad a = 5000, \quad b = 2200$$

$$s_n = \frac{n}{2} [2a + (n-1)d]$$

$$= \frac{3}{2} [2(5000) + (3-1)2200]$$

$$S_3 = \frac{3}{2} (10000 + 2 \times 2200)$$

$$= \frac{3}{2} (10000 + 4400)$$

$$= 3 \times 7200$$

$$= 21600$$

The production during first 3 year is 21600

$$(iii) a_4 = a + 3d$$

$$= 5000 + 3(2200)$$

$$= 5000 + 6600$$

$$= 11600$$

$$a_7 = a + 6d$$

$$= 5000 + 6 \times 2200$$

$$= 5000 + 13200$$

$$= 18200$$

$$a_7 - a_4 = 18200 - 11600 = 7400$$

37) coordinates of A (2,3)- Alia is house

coordinates of B (2,1)- Shagun is house

coordinates of C (4,1)- library

(i)  $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$$= \sqrt{(2 - 2)^2 + (1 - 3)^2}$$

$$= \sqrt{(0^2 + (-2)^2)}$$

$$AB = \sqrt{0 + 4} = \sqrt{4} \text{unit} = 2 \text{ units}$$

Alia's house from shagun's house is 2 unit

1/2

1/2

(ii) C(4,1), B(2,1)

$$CB = \sqrt{(2 - 4)^2 + (1 - 1)^2}$$

$$= \sqrt{(-2)^2 + 0^2}$$

$$= \sqrt{4 + 0} = \sqrt{4} = 2 \text{ unit}$$

1/2

1/2

(iii) O(0,0), B(2,1)

$$OB = \sqrt{(2 - 0)^2 + (1 - 0)^2}$$

$$= \sqrt{2^2 + 1^2} = \sqrt{4 + 1} = \sqrt{5} \text{ units}$$

1

Distance between Alia's house and Shagun's house AB = 2 units

Distance between Library and Shagun's house CB = 2 units

1/2

OB is greater than AB and CB,

1/2

For shagun, school [O] is farther than Alia's house [A] and Library [C]

OR

C (4,1) A(2,3)

$$CA = \sqrt{(2 - 4)^2 + (3 - 1)^2}$$

$$= \sqrt{(-2)^2 + 2^2} = \sqrt{4 + 4} = \sqrt{8}$$

$$= 2\sqrt{2} \text{ units} \quad AC^2 = 8$$

1

Distance between Alia's house and Shagun's house AB = 2 units

Distance between Library and Shagun's house CB = 2 units

1/2

$$AC^2 + BC^2 = 2^2 + 2^2 = 4 + 4 = 8$$

1/2

Therefore A,B and C form a right triangle.

38) (i)  $XY \parallel CD$  and AC is transversal.

$$\angle ACD = \angle CAX \text{ (alt.int } \angle S)$$

$$\angle ACD = 30^\circ$$

(ii)  $\angle YAB = 30^\circ$

$$\angle ABD = 30^\circ$$

Because  $XY \parallel CD$  and AB is a transversal

so alternate interior angles are equal

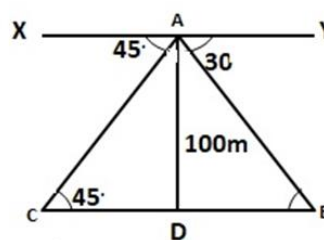
$$\angle YAB = \angle ABD$$

1/2

1/2

1/2

1/2



(iii) CD=?

$$\text{In } \triangle ADC \theta = 45^\circ$$

$$\tan \theta = \frac{P}{B} \quad 1/2$$

$$\tan 45^\circ = \frac{100}{B}$$

$$1 = \frac{100}{B} \quad 1/2$$

$$B=100\text{m}$$

$$CD = 100\text{m} \quad 1$$

**OR**

BD=?

$$\text{In } \triangle ABD \theta = 30^\circ$$

$$\tan \theta = \frac{P}{B} \quad 1/2$$

$$\tan 30 = \frac{100}{BD}$$

$$\frac{1}{\sqrt{3}} = \frac{100}{BD} \quad 1/2$$

$$BD = 100\sqrt{3} \text{ m} \quad 1$$