AJ INSTITUTE OF ENGINEERING & TECHNOLOGY

DEPT. OF TRAINING & PLACEMENT

Test-10

Height and distance, Simplification

Wednesday 10th July 2024

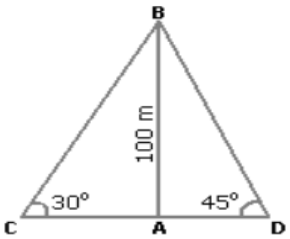
1. Two ships are sailing in the sea on the two sides of a lighthouse. The angle of elevation of the top of the lighthouse is observed from the ships are 30° and 45° respectively. If the lighthouse is 100 m high, the distance between the two ships is:

a) 173 m
b) 200 m
c) 273 m
d) 300 m

Answer: Option ©

Explanation:

Let AB be the lighthouse and C and D be the positions of the ships.



Then, AB = 100 m, ∠ACB = 30° and ∠ADB = 45°.

$\frac{AB}{AC} = \tan 30° = \frac{1}{\sqrt{3}} \Rightarrow AC = AB \times \sqrt{3} = 100\sqrt{3}$ m.

$\frac{AB}{AD} = \tan 45° = 1 \Rightarrow AD = AB = 100$ m.

$\therefore CD = (AC + AD) = (100\sqrt{3} + 100)$ m

$= 100(\sqrt{3} + 1)$

$= (100 \times 2.73)$ m

$= 273$ m.

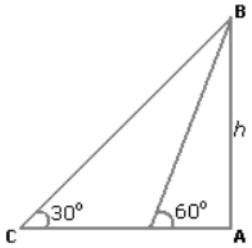
2. A man standing at a point P is watching the top of a tower, which makes an angle of elevation of 30° with the man's eye. The man walks some distance towards the tower to watch its top and the angle of the elevation becomes 60°. What is the distance between the base of the tower and the point P?

a) $4\sqrt{3}$ units
b) 8 units
c) 12 units
d) Data inadequate

Answer: Option ⓓ

Explanation:

One of AB, AD and CD must have given.



So, the data is inadequate.

3) The angle of elevation of a ladder leaning against a wall is 60° and the foot of the ladder is 4.6 m away from the wall. The length of the ladder is:

a) 2.3 m

b) 4.6 m

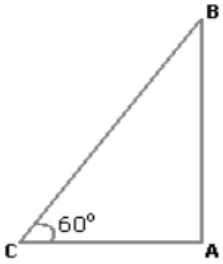
c) 7.8 m

d) 9.2 m

Answer: Option ⓓ

Explanation:

Let AB be the wall and BC be the ladder.



Then, $\angle ACB = 60°$ and $AC = 4.6$ m.

$\frac{AC}{BC} = \cos 60° = \frac{1}{2}$

$\Rightarrow BC = 2 \times AC$

$= (2 \times 4.6)$ m

$= 9.2$ m.

4) From a point P on a level ground, the angle of elevation of the top tower is 30°. If the tower is 100 m high, the distance of point P from the foot of the tower is:

a) 149 m

b) 156 m

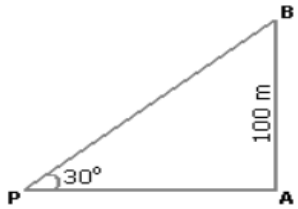
c) 173 m

d) 200 m

Answer: Option ©

Explanation:

Let AB be the tower.



Then, ∠APB = 30° and AB = 100 m.

$\frac{AB}{AP} = \tan 30° = \frac{1}{\sqrt{3}}$

$\Rightarrow AP = (AB \times \sqrt{3})\ m$

$= 100\sqrt{3}\ m$

$= (100 \times 1.73)\ m$

$= 173\ m.$

5) The angle of elevation of the sun, when the length of the shadow of a tree √3 times the height of the tree, is:

a) 30°

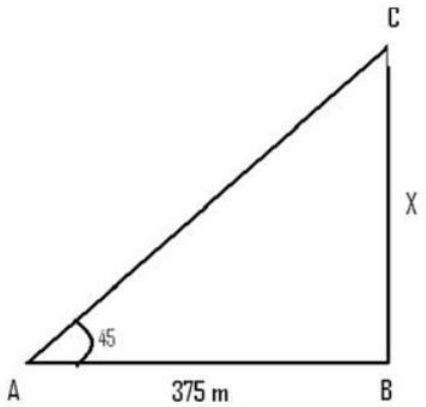
b) 45°

c) 60°

d) 80°

Answer - A

Explanation



From the right angled triangle
Tan(45°)= X/375
=> X = 375 m

6) A ladder is leaning against a wall. It makes a 60° angle with the wall. If the distance between foot of ladder and wall is 5.5 meters, find the length of the ladder.

A. 9.5m

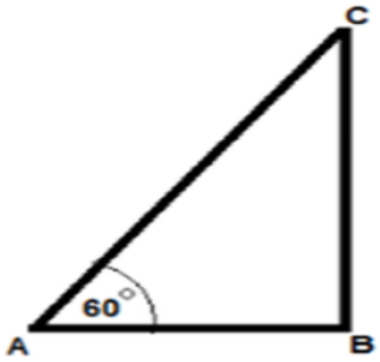
B. 10m

C. 10.5m

D. 11m

The Correctoption is(D)

Answer with explanation:



Let BC be the wall and AC be the ladder.

∠BAC = 60° and AB = 5.5 meter

$$\frac{AB}{AC}\left(\frac{Base}{Hypotenuse}\right) = \cos 60° \left(\frac{1}{2}\right)$$

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

AC = 2 * AB

= 2 * 5.5 = 11 meters (Option D)

7) A man 1.5 meter tall is 30√3 meter away from a building. When he sees the top of building the angle of elevation is 30°. Find the height of the building?

A. 31.5m

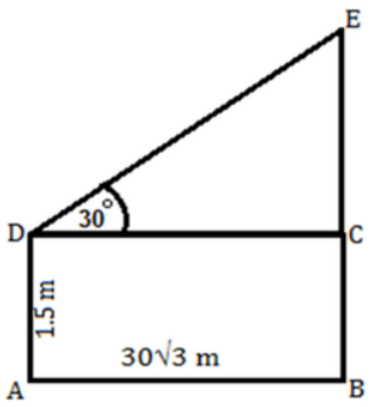
B. 30 m

C. 53.4m

D. 48 m

The Correctoption is(A)

Answer with explanation:



Let AD be the man and BE the building.

Now draw a line DC so that DC is perpendicular to BE.

Now, BC = AD = 1.5 m

And, DC = AB = 30√3 m

$$\frac{EC}{DC}\left(\frac{Perpendicular}{Base}\right) = \tan 30° \left(\frac{1}{\sqrt{3}}\right)$$

$$\frac{EC}{30\sqrt{3}} = \frac{1}{\sqrt{3}}$$

$$EC = \frac{30\sqrt{3}}{\sqrt{3}} = 30 \text{ m}$$

Now, Height of building, BE = BC + EC

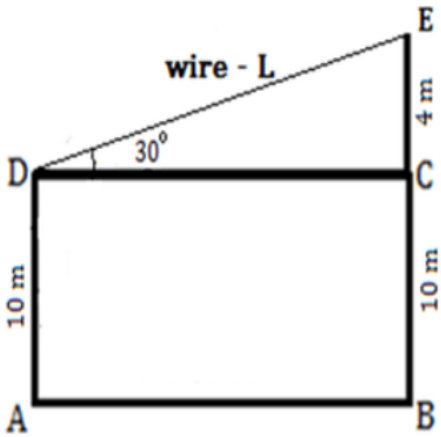
= 1.5 + 30 = 31.5 m (Option A)

8) The tops of two poles are connected by a wire. The heights of the poles are 10 m and 14 m respectively. If the wire makes a 30° angle with the horizontal, find the length of the wire?

A. 7 m
B. 7.5m
C. 8m
D. 8.5m

The Correctoption is(C)

Answer with explanation:



Let AD and BE, be the poles of height 10 m and 14 m respectively.

DE is the wire of length = L

DC is parallel to AB so AD = BC = 10 m

So, CE = BE - BC = 14 - 10 = 4 m

$$\text{Now, } \frac{CE}{DE}\left(\frac{Perpendicular}{\text{Hypotenuse}}\right) = \text{Sin } 30° \left(\frac{1}{2}\right)$$

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

$$\frac{4}{L} = \frac{1}{2}$$

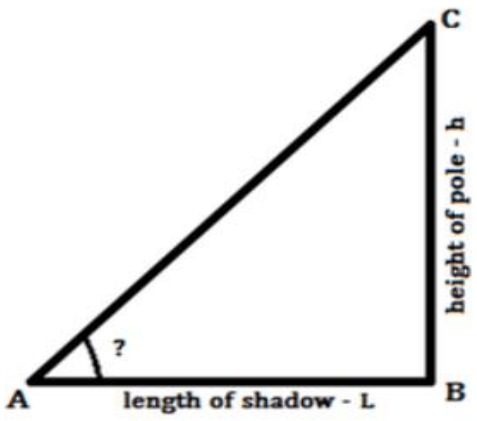
$$L = 4 * 2 = 8 \text{ m (Option C)}$$

9) The angle of elevation of the sun when the length of the shadow of a pole is equal to the height of the pole is?

A. 45°
B. 30°
C. 60°
D. 90°

The Correctoption is(A)

Answer with explanation:



Let ∠BAC = θ

Let height of pole is h and length of the shadow is L.

As per question L = h

$$\frac{h}{L}\left(\frac{Perpendicular}{Base}\right) = \tan\theta$$

$$\text{We have} = h = L$$

$$\frac{h}{h} = \tan\theta$$

tan θ = 1

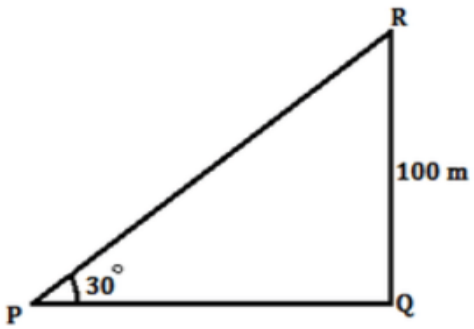
So, when tan θ is equal to 1 the angle will be 45° (Option A)

10) A man sees the top of a tower from a point P. It makes an angle of elevation of 30° with the man's eyes. If the height of the tower is 100 m, find the distance between man and tower?

A. 57.8 m
B. 110 m
C. 173 m
D. 140 m

The Correctoption is(C)

Answer with explanation:



$$\frac{RQ}{PQ}\left(\frac{\text{Perpendicular}}{\text{Base}}\right) = \tan 30°$$

$$\frac{100\text{ m}}{PQ} = \tan 30° \left(\frac{1}{\sqrt{3}}\right)$$

$$\frac{100}{PQ} = \frac{1}{\sqrt{3}}$$

PQ = 100 * √3

PQ = 100 * 1.73

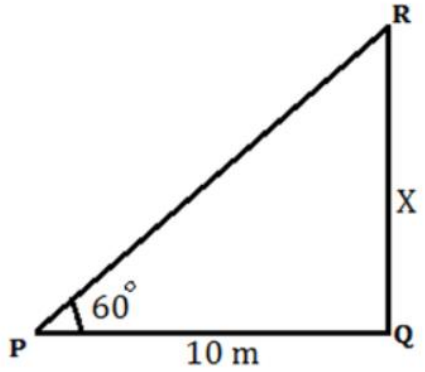
= 173 m (Option C)

11) A storm breaks a tree. The broken part of tree bends so that the top of the tree touches the ground and makes an angle of 60° with the horizontal plane. If the distance between the base of the tree and the point where top of tree touches the ground is 10 m, find the height of the tree?

A. 37.3 m
B. 17.3 m
C. 27.3 m
D. 20.3 m

The Correctoption is(A)

Answer with explanation:



PQ = 10 and let RQ be X.

$$\frac{RQ}{PQ}\left(\frac{\text{Perpendicular}}{\text{Base}}\right) = \tan 60°(\sqrt{3})$$

$$\frac{X}{10} = \sqrt{3}$$

$X = 10\sqrt{3}$

Now, $PR^2 = X^2 + (10)^2$

$PR2 = (10\sqrt{3})^2 + (10)^2$

$= 300 + 100$

$PR2 = 400$

$PR = 20$

Height of tree = RQ + PR

$= X + 20$

$= 10\sqrt{3} + 20$

$= 10 * 1.73 + 20$

$= 17.3 + 20$

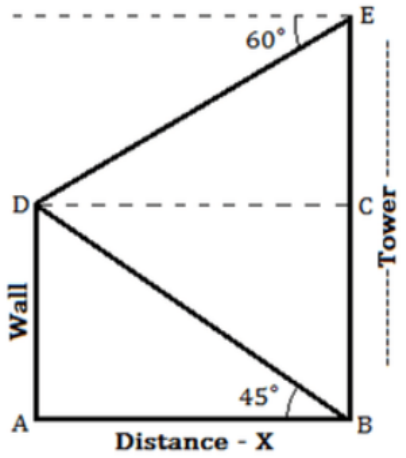
= 37.3 meter (Option A)

12) The top of a 30 m high wall makes an angle of elevation of 60° with the top of a tower and makes an angle of depression of 45° with the bottom of the tower. Find the distance between tower and wall?

A. 27 m
B. 28 m
C. 29 m
D. 30 m

The Correctoption is(D)

Answer with explanation:



Let AD is the wall of height 30 m and BE is the tower and X be the distance between tower and wall.

$$\frac{AD}{AB}\left(\frac{Perpendicular}{Base}\right) = \tan 45^\circ\,(=1)$$

$$\frac{30}{X} = 1$$

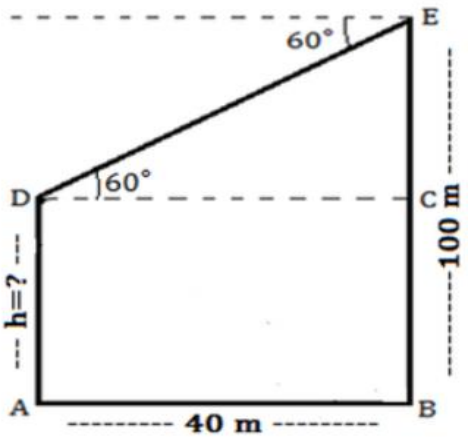
X = 30 m (Option D)

13) Two buildings are 40 m apart. The angle of depression of the top of one building of height 100 m with the top of second building of unknown height is 60°. Find the height of second building?

A. 30.8 m
B. 60 m
C. 76.8 m
D. 40.5 m

The Correctoption is(A)

Answer with explanation:



Le t the height of the second building AD be h.

EC = 100 - h

DC = AB = 40

$$\frac{EC}{DC}\left(\frac{Perpendicular}{Base}\right) = \tan 60° \ (= \sqrt{3}\ )$$

$$\frac{100-h}{40} = \sqrt{3}$$

100 -h = 40 * √3

- h = -100 + 40 * 1.73

- h = -100 + 69.2

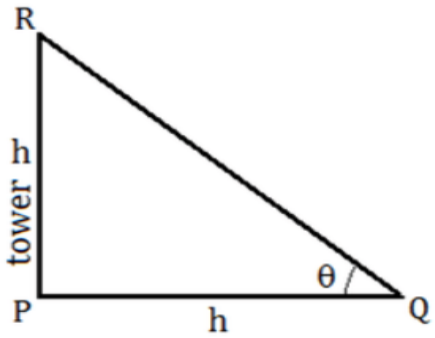
h = 30.8 m (Option A)

14) The angle of elevation of the top of a tower of height h meter at point Q is θ. If the distance between point Q and base of the tower is equal to the height of the tower, find the value of θ?

A. 60°
B. 30°
C. 45°
D. any acute angle

The Correctoption is(C)

Answer with explanation:



Let the height of tower PR be h.

PQ = h as point Q is at a distance of h meter from the base of tower.

$$\text{Then, } \frac{PR}{PQ}\left(\frac{Perpendicular}{Base}\right) = \tan\ \theta$$

$$\frac{h}{h} = \tan\ \theta$$

tan θ=1

tanθ= 45° (Option C)

15) A man has Rs.480 in the denominations of one-rupee notes, five-rupee notes and ten-rupee notes. The number of notes of each denomination is equal. What is the total number of notes that he has ?

a) 45

b) 60

c) 75

d) 90

Answer: Option (D)

Explanation:

Let number of notes of each denomination be x .

Then $x + 5x + 10x = 480$

$\Rightarrow 16x = 480$

$\therefore x = 30.$

Hence, total number of notes = $3x = 90.$

16) There are two examinations rooms A and B. If 10 students are sent from A to B, then the number of students in each room is the same. If 20 candidates are sent from B to A, then the number of students in A is double the number of students in B. The number of students in room A is:

a) 20

b) 80

c) 100

d) 200

Answer: Option (C)

Explanation:

Let the number of students in rooms A and B be x and y respectively.

Then, $x - 10 = y + 10 \Rightarrow x - y = 20$ .... (i)

and $x + 20 = 2(y - 20) \Rightarrow x - 2y = -60$ .... (ii)

Solving (i) and (ii) we get: $x = 100$, $y = 80.$

$\therefore$ The required answer A = 100.

17) The price of 10 chairs is equal to that of 4 tables. The price of 15 chairs and 2 tables together is Rs. 4000. The total price of 12 chairs and 3 tables is:

a) Rs. 3500

b) Rs. 3750

c) Rs. 3840

d) Rs. 3900

Answer: Option (D)

Explanation:

Let the cost of a chair and that of a table be Rs. x and Rs. y respectively.

Then, $10x = 4y$ or $y = \frac{5}{2}x$.

$\therefore 15x + 2y = 4000$

$\Rightarrow 15x + 2 \times \frac{5}{2}x = 4000$

$\Rightarrow 20x = 4000$

$\therefore x = 200.$

So, $y = \left(\frac{5}{2} \times 200\right) = 500.$

Hence, the cost of 12 chairs and 3 tables = $12x + 3y$

= Rs. (2400 + 1500)

= Rs. 3900.

18) If $a - b = 3$ and $a^2 + b^2 = 29$, find the value of ab.

a) 10

b) 12

c) 15

d) 18

Answer: Option (A)

Explanation:

$2ab = (a^2 + b^2) - (a - b)^2$

= 29 - 9 = 20

$\Rightarrow ab = 10.$

19) The price of 2 sarees and 4 shirts is Rs. 1600. With the same money one can buy 1 saree and 6 shirts. If one wants to buy 12 shirts, how much shall he have to pay ?

a) Rs. 1200

b) Rs. 2400

c) Rs. 4800

d) Cannot be determined

Answer: Option Ⓑ

Explanation:

Let the price of a saree and a shirt be Rs. x and Rs. y respectively.

Then, $2x + 4y = 1600$ .... (i)

and $x + 6y = 1600$ .... (ii)

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Divide equation (i) by 2, we get the below equation. => x + 2y = 800. --- (i
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Solving (i) and (ii) we get $x = 400$, $y = 200$.

$\therefore$ Cost of 12 shirts = Rs. (12×200) = Rs. 2400.

20) A sum of Rs. 1360 has been divided among A, B and C such that A gets $\frac{2}{3}$ of what B gets and B gets $\frac{1}{4}$ of what C gets. B's share is:

a) Rs. 120

b) Rs. 160

c) Rs. 240

d) Rs. 300

Answer: Option Ⓒ

Explanation:

Let C's share = Rs. x

Then, B's share = Rs. $\frac{x}{4}$, A's share = Rs. $\left(\frac{2}{3} \times \frac{x}{4}\right)$ = Rs. $\frac{x}{6}$

$\therefore \frac{x}{6} + \frac{x}{4} + x = 1360$

$\Rightarrow \frac{17x}{12} = 1360$

$\Rightarrow x = \frac{1360 \times 12}{17}$ = Rs. 960

Hence, B's share = Rs. $\left(\frac{960}{4}\right)$ = Rs. 240.

21) One-third of Rahul's savings in National Savings Certificate is equal to one-half of his savings in Public Provident Fund. If he has Rs. 1,50,000 as total savings, how much has he saved in Public Provident Fund ?

a) Rs. 30,000

b) Rs. 50,000

c) Rs. 60,000

d) Rs. 90,000

Answer: Option Ⓒ

Explanation:

Let savings in N.S.C and P.P.F. be Rs. x and Rs. (150000 - x) respectively. Then,

$\frac{1}{3}x = \frac{1}{2}(150000 - x)$

$\Rightarrow \frac{x}{3} + \frac{x}{2} = 75000$

$\Rightarrow \frac{5x}{6} = 75000$

$\Rightarrow x = \frac{75000 \times 6}{5} = 90000$

$\therefore$ Savings in Public Provident Fund = Rs. (150000 - 90000) = Rs. 60000

22) A fires 5 shots to B's 3 but A kills only once in 3 shots while B kills once in 2 shots. When B has missed 27 times, A has killed:

a) 30 birds

b) 60 birds

c) 72 birds

d) 90 birds

Answer: Option Ⓐ

Explanation:

Let the total number of shots be x. Then,

Shots fired by A = $\frac{5}{8}x$

Shots fired by B = $\frac{3}{8}x$

Killing shots by A = $\frac{1}{3}$ of $\frac{5}{8}x = \frac{5}{24}x$

Shots missed by B = $\frac{1}{2}$ of $\frac{3}{8}x = \frac{3}{16}x$

$\therefore \frac{3x}{16} = 27$ or $x = \left(\frac{27 \times 16}{3}\right) = 144.$

Birds killed by A = $\frac{5x}{24} = \left(\frac{5}{24} \times 144\right) = 30.$

23) To fill a tank, 25 buckets of water is required. How many buckets of water will be required to fill the same tank if the capacity of the bucket is reduced to two-fifth of its present?

a) 10

b) 35

c) 62.5

d) Cannot be determined

Answer: Option Ⓒ

Explanation:

Let the capacity of 1 bucket = x.

Then, the capacity of tank = $25x$.

New capacity of bucket = $\frac{2}{5}x$

$\therefore$ Required number of buckets = $\frac{25x}{(2x/5)}$

$= \left(25x \times \frac{5}{2x}\right)$

$= \frac{125}{2}$

$= 62.5$

24) In a regular week, there are 5 working days and for each day, the working hours are 8. A man gets Rs. 2.40 per hour for regular work and Rs. 3.20 per hours for overtime. If he earns Rs. 432 in 4 weeks, then how many hours does he work for ?

a) 160

b) 175

c) 180

d) 195

Answer: Option Ⓑ

Explanation:

Suppose the man works overtime for x hours.

Now, working hours in 4 weeks = $(5 \times 8 \times 4) = 160$.

$\therefore$ $160 \times 2.40 + x \times 3.20 = 432$

$\Rightarrow 3.20x = 432 - 384 = 48$

$\Rightarrow x = 15$.

Hence, total hours of work = $(160 + 15) = 175$.

25) Free notebooks were distributed equally among children of a class. The number of notebooks each child got was one-eighth of the number of children. Had the number of children been half, each child would have got 16 notebooks. Total how many notebooks were distributed ?

a) 256

b) 432

c) 512

d) 640

Answer: Option ©

Explanation:

Let total number of children be x .

Then, $x \times \frac{1}{8}x = \frac{x}{2} \times 16 \Leftrightarrow x = 64.$

$\therefore$ Number of notebooks $= \frac{1}{8}x^2 = \left(\frac{1}{8} \times 64 \times 64\right) = 512.$

26) A man has some hens and cows. If the number of heads be 48 and the number of feet equals 140, then the number of hens will be:

a) 22

b) 23

c) 24

d) 26

Answer: Option Ⓓ

Explanation:

Let the number of hens be x and the number of cows be y .

Then, $x + y = 48$ .... (i)

and $2x + 4y = 140 \Rightarrow x + 2y = 70$ .... (ii)

Solving (i) and (ii) we get: $x = 26, y = 22.$

$\therefore$ The required answer = 26.

27) When 60 - [30 -{35 -(15-*)}] = 60, then * is equal to

A. -19
B. 35
C. 20
D. -29

Answer: B

Explanation:

35 - [30 -{35 -(15 -*)}] = 60
35 - [30 -{35 -15 +*}] = 60
35 - [30 - {20 + *}] = 60
35 -[30 - 20 - *] = 60
35 -[10 - *] = 60
35 - 10 + * = 60
25 + * = 60
* = 60 - 25 = 35

28) A 100-gm packet of grains costs Rs. 7.55, what will be the cost price of $2\frac{1}{2}$ kg packet?

A. Rs. 188.10
B. Rs. 186.75
C. Rs. 187.85
D. Rs. 188.75

Answer: D

Explanation:

We have $2\frac{1}{2}$ kg = 2500 gm
Now,
The cost of 100 gm grain = Rs. 7.55
The cost of 1 gm grain = 7.55/100
The cost of 2500 gm grain = 7.55/100 × 2500=7.55 × 25
=Rs.188.75

29) A boy was asked to multiply a certain number by 25. He multiplied it by 52 and got his answer more than the correct one by 324.The number to be multiplied was

A. 12
B. 15
C. 25
D. 32

Answer: A

Explanation:

Let the required number be x. then

According to the question:

$52x - 25x = 324$

$27x = 324$

$X = \frac{324}{27} = 12$

30) $\frac{8.73 \times 8.73 \times 8.73 + 4.27 \times 4.27 \times 4.27}{8.73 \times 8.73 - 8.73 \times 4.27 + 4.27 \times 4.27} = ?$

A. 11
B. 12
C. 13
D. None of these.

Answer: C

Explanation:

$$= \frac{8.73 \times 8.73 \times 8.73 + 4.27 \times 4.27 \times 4.27}{8.73 \times 8.73 - 8.73 \times 4.27 + 4.27 \times 4.27}$$

$$= \frac{(8.73)^3 + (4.27)^3}{(8.73)^2 - 8.73 \times 4.27 + (4.27)^2}$$

$$\because a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

Therefore,

$$\frac{(a)^3 + (b)^3}{(a)^2 - a \times b + (b)^2}$$

$$= \frac{(a + b)(a^2 - ab + b^2)}{a^2 - ab + b^2}$$

$$= (a + b)$$

Where a = 8.73, and b = 4.27

Now putting the value of a, and b in above equation

(a + b) = (8.73 + 4.27) = 13