1. The sum of binary numbers 11111 and 00001 is given by:

1) 100100 2) 100000 3) 100001 4) 100010

Ans: 2

2. A train travels from Chennai to Madurai at a constant speed 60 kmph and return a constant speed of 30 kmph. The average speed of the train is:

1) 40 kmph 2) 45kmph 3) cannot be determined 4)Data insufficient

Ans: a (Note: Avg. speed = $\frac{2xy}{x+y} = \frac{2x60x30}{60+30} = 40$)

3. A bus starts from rest with a constant acceleration of 10 m/sec^2. At the same time car travelling with a constant velocity of 60 m/sec overtakes the bus. At what distance will the bus overtake the car?

1) 360 m 2) 720 m

3) 1.4 km 4) Bus will never overtake the car

Ans:4 (Time taken by car to meet the bus: v.t = 1/2a.t^2

60xt = ½ x10xt^2 → 12 sec.

Once the car overtaken the bus, the distance travelled by the car in unit time is greater than the distance travelled by the bus and hence bus will never overtake the car.

3.1. Two trains *A* and *B* are running on parallel tracks in the same direction at the same speed of 80kmph. After time 't' the train *A* retards to half its speed and train *B* acceleration to double the Speed. The relative speed between the trains *A* and *B* after time 't' kmph is:

1) 80 kmph 2) 160kmph 3) 120 kmph

4) Cannot be determined because initial distance between the two trains is not given

Ans: 3

Explanation
After time, t, Speed of train B is (80+80) kmph = 160 kmph and
Speed of train A is 40 kmph
∴ Relative speed between them = 160 -40 = 120 kmph

4. The average marks obtained by a student in 6 subjects is 88. On subsequent verification it was found that the marks obtained by him in a subject was wrongly copied as 86 instead of 68. The correct average of the marks obtained by him is-

1.85 2.87 3.84 4.86

Ans. 1

Explanation

Total marks in 6 subjects = 88×6 = 528;

Total marks after correct the error = 528 -86 + 68 = 510;

Hence, the correct average marks = $\frac{510}{6}$ = 85

5. Find the mode of 0, 0, 2, 2, 3, 3, 3, 4, 5, 5, 5, 5, 6, 6, 7, 8

1. 7 2. 0 3. 5 4. 2

Ans:3

The given 16 numbers are written in increasing order:

0, 0, 2, 2, 3, 3, 3, 4, 5, 5, 5, 5, 6, 6, 7, 8.
The most repeating number is 5. Hence, 5 is the mode.

7. If the volume of a sphere is numerically equal to its surface area; the diameter is;

1. 4cm 2. 2 cm 3. 3 cm 4. 6 cm

Ans. 3

Explanation

Numerically Volume = Surface Area

$\frac{4}{3}\pi\times r^3 = 4\times \pi\times r^2$;

$r^3 = 3r \rightarrow r = 3$ cm;

8. A train runs at an average speed of 75 km/hr. If the distance to be covered is 1050 km. How long will the train take to cover it?

1. 13hr 2. 14hr 3. 12 hr 4. 15 hr

Ans. 2

Explanation

The time taken by train = $\frac{Distance}{AverageSpeed} \rightarrow t = \frac{D}{S} = \frac{1050}{75}$ = 14 hr.

10. If the altitude of an equilateral triangle is $12\sqrt{3}$ cm, then its area would be:

1. 12 sq. cm. 2. 72 sq. cm. 3. $36\sqrt{3}$ sq. cm. 4. $144\sqrt{3}$ sq. cm.

Ans. 4

Explanation

h= $\frac{a\sqrt{3}}{2}$

A = $\frac{h^2}{\sqrt{3}} = \frac{(12\sqrt{3})^2}{\sqrt{3}} = 144\sqrt{3}$

11. The minimum value of $2\sin^2\theta + 3\cos^2\theta$ is

1. 1 2. 3 3.2 4. 4

Ans. 1

Explanation

$2\sin^2\theta + 3\cos^2\theta = 2\times(\sin^2\theta + \cos^2\theta) + \cos^2\theta = 2 + \cos^2\theta$

($\sin^2\theta + \cos^2\theta = 1$ for all values of θ)

Minimum value pertains if $\theta = 180^o$

= 2 -1 =1 (for cos180 =-1)

12. If number of vertices, edges and faces of a rectangular parallelepiped are denoted by v, e and f respectively, the value of (v – e + f) is

1. 4 2. 2 3. 1 4. 0

Ans. 2

Explanation

The rectangular parallelepiped has 8 vertices (v), 12 edges (e), and 6 faces(f).

Hence, V – E + F = 8 – 12 + 6 = 2. (This is Euler's formula for a polyhedron)

Box: Euler formula for a polyhedron

Euler formula for a tetrahedron: it relates, the number of faces, vertices, and edges of any polyhedron. It is written $\boldsymbol{F} + \boldsymbol{V} = \boldsymbol{E} + 2$, where $\boldsymbol{F}$ is the number of faces, $\boldsymbol{V}$ the number of vertices, and $\boldsymbol{E}$ the number of edges. A cube, for example, has 6 faces, 8 vertices, and 12 edges and satisfies this formula.

13. 5 persons will live in a tent. If each person requires $16m^2$ floor area and $100m^3$ space for air then the height of the cone of smallest size to accommodate these persons would be?

1. 18.75 m 2. 16m 3. 10.25 m 4. 20 m

Ans. 1

Explanation

The required floor area/person = 16 sq. m

For 5 persons, floor area required = 80 sq. m

For 5 persons, space required inside the tent = 100x5 = $500m^3$

Let the radius of tent be r meter and height be h m.

Base area $= \pi \times r^2 = 80 \rightarrow r = \sqrt{25.4545} = 5.045$ m

The volume of air required = $5 \times 100\ m^3$

$1/3 \times \pi \times r^2 \times h = 500 \rightarrow h = 18.75$ m.

14. The difference between successive discounts of 40% followed by 30% and 45% followed by 20% on the marked price of an article is Rs. 12. The marked price of the article is:

1. Rs. 400 2. Rs. 200 3. Rs. 800 4.Rs. 600

Ans. 4

Explanation

Suppose, the marked price of the article= Rs. x;

The price after 40% and 30% successive discounts = $x \times 0.60 \times 0.70 = 0.42x$;

The price after 45% and 20% successive discounts = $x \times 0.55 \times 0.80 = 0.44x$;

Given: $0.44x - 0.42x = 0.02x = 12 \rightarrow x$ = Rs. 600.

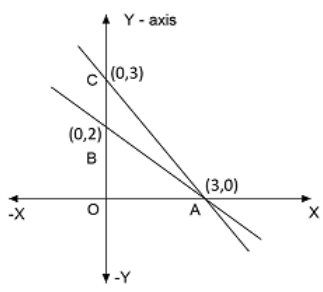
.15. The area of the triangle formed by the graphs of the equation x=0, 2x + 3y=6 and x + y = 3 is:

1. 1 sq. unit 2.1.5 sq. unit 3. 1 sq. unit 4. 4.5 sq. unit

Ans. 2

Explanation

The sum is represented in the following figure:



The sum is to find the area of triangle ABC.

The area of triangle $=\frac{1}{2} \times$ base $\times$ height

Area of triangle ABC = Area of triangle OAC - Area of triangle OAB

$= \frac{1}{2} \times 3 \times (3-2) = 1.5$

16. Among the following equations,

$x + 2y + 9 = 0$;

$5x - 4 = 0$;

$2y - 13 = 0$;

$2x - 3y = 0$, the equation of the straight line not passing through origin is-

1. $2x - 3y = 0$ 2. $5x - 4 = 0$ 3. $x + 2y + 9 = 0$ 4. $2y - 13 = 0$

Ans.(3)

Explanation

Examine the given options:

$x + 2y + 9 = 0$; (this line will intersect both the axes)

$5x - 4 = 0$; (This line will be parallel to Y-axis), i.e., $x = \frac{4}{5}$, a constant

$2y - 13 = 0$; (This line will be parallel to X-axis) $y = \frac{13}{2}$, a constant

$2x - 3y = 0$; (This line will pass through the origin) $\frac{x}{y} = \frac{3}{2} \rightarrow y = \frac{2}{3}x$ (y = mx form)

17. The HCF of $x^8 - 1$ and $x^4 + 2x^3 - 2x - 1$ is:

1. $x^2 + 1$ 2. $x + 1$ 3. $x^2 - 1$ 4. $x - 1$

Ans. 3

Explanation

$x^2 - 1 = (x + 1)(x - 1) \rightarrow x = -1, 1$;

Both the values of x will satisfy the other equation;

1. $x^8 - 1 = (x^4 + 1)(x^4 - 1) = (x^4 + 1)(x^2 + 1)(x^2 - 1) = (x^4 + 1)(x^2 + 1)(x + 1)(x - 1)$
2. $x^4 + 2x^3 - 2x - 1 = (x^4 - 1) + 2x^3 - 2x$

$= (x^2 - 1)(x^2 + 1) + 2x(x^2 - 1)$

$= (x^2 - 1)(x^2 + 1 + 2x)$

$= (x + 1)(x - 1)(x + 1)^2$

$\therefore$ H.C.F $= (x + 1)(x - 1) = (x^2 - 1)$

Hence, $(x^2 - 1)$ will be the appropriate answer.

18 The least number which when divided by 6, 9, 12, 15, 18 leaves the same remainder 2 in each case is:

1. 178 2.182 3. 176 4. 180

Ans. 2

Explanation

The LCM of these numbers = LCM (6, 9, 12, 15, 18) = 180;

Hence, the appropriate answer = 180 + 2 = 182;

∴ The number is **182** which when is divided by 6,9,12,15 and 18 leaves remainder as 2 in each case.

19. A certain sum will amount to Rs. 12,100 in 2 years at 10% per annum of compound interest, interest being compounded annually. The sum is-

1. Rs. 12000 2. Rs. 6000 3. Rs. 8000 4.Rs. 10000

Ans. 4

Explanation

For CI case: $A = P(1 + R/100)^n$;

$12100 = P(1 + 0.1)^2 = P \times 1.1 \times 1.1 \rightarrow P = Rs.\ 10000.$

21. A's 2 days work is equal to B's 3 days work. If A can complete the work in 8 days then to complete the work B will take:

1. 14 days 2. 15 days 3. 16 days 4.12 days

Ans. 4.

Explanation

Same work is completed by A in 2 days and B in 3 days

∴ A's 8 days duration will be equal to $\frac{8}{2}$ x3 = 12 days for B .

22. If the measure of three angles of a triangle are in the ratio 2: 3: 5, then the triangle is:

1.Equilateral 2.Isosceles 3, obtuse angled 4.right angled

Ans.4

Explanation

Let the angles be 2x, 3x and 5x.

Total of 3 angles = $2x + 3x + 5x = 180^o \rightarrow x = 18$;

Hence, the angles are 36, 54, and 90. Therefore, the triangle will be right-angled.

23. What must be added to each term of the ratio 2 :5, so that it may equal to 5 : 6?

1. 12 2. 78 3. 65 4.13

Ans. 4

Explanation

$(2 + x)::(5 + x) = 5::6$

$\rightarrow 6(2 + x) = 5(5 + x) \rightarrow 12 + 6x = 25 + 5x \rightarrow x = 13$;

24. The radius of a circle, whose area is equal to the sum of the area of two circles of radii 3 cm and 4 cm is

1. 6 cm 2. 5 cm 3. 3.5 cm 4. none of these

Ans:2

Explanation

$\pi R^2 = \pi.3^2 + \pi.4^2 = \pi.25^2$

$\therefore R = 5$

(Note: Quick answer can be arrived by assuming Pythagorean triples. It should take about 10 seconds only)

25. 4 men and 6 women complete a work in 8 days, 2 men and 9 women also complete in 8 days. The number of days required for 18 women complete the work is:

1. 4 2/3 days 2. 5 2/3 days 3. 4 1/3 days 4.5 1/3 days

Ans. 4

Explanation

Let the one day work of a man and women be m, w respectively

$4m + 6w = 8$ and $2m + 9w = 8$;

To complete the work in one day, $(4m + 6w) \times 8 = (2m + 9w) \times 8$;

$\rightarrow 2m = 3w$, i.e., 2 men's work is equivalent to 3 women

As per the given condition 1, $4m + 6w = 8 \rightarrow 6w + 6w = 8$

i.e., 12 women can complete the work in 8 days

$\therefore$ 18 women complete te work in$(12/18) \times 8 = 16/3 = 5\frac{1}{3}$

26. If $5x + 9y = 5$ and $125x^3 + 729y^3 = 120$, then the product of x and y is

1. 135 2. $\frac{1}{135}$ 3. 1/9 4. 45

Ans. 2

Explanation

Given: $5x + 9y = 5$;

Taking cubes of both sides: $(5x + 9y)^3 = 5^3$;

$(5x + 9y)^3 = 125x^3 + 729y^3 + 3\times5x \times9y (5x + 9y)$

$=125x^3 + 729y^3 + 135xy (5x + 9y)$

$= 120 + 135xy (5) = 120 + 675xy = 5^3 = 125 \rightarrow xy = 5/675 = 1/135.$

27. If 4 men or 8 women can do a piece of work in 15 days, in how many days can 6 men and 12 women do the same piece of work?

1. 45 days 2. 20 days 3. 5 days 4. 30 days

Ans. 3

Explanation

Treat the sum in terms of men.

Given 4 men's work = 8 women's work,

i.e., 1 man's work = 2 women's work

Number of days required to complete the work by 6 men + 12 women

Work of 6 men + 12 women = 6 + 6 =12 men work

Men	Number of days
4	15
12	x

$\therefore x = 4x15/12 = 5$

28. The value of $\sin^2 22^0 + \sin^2 68^0 + \cot^2 30^0$ is

1. ¾ 2. 4 3. 5/4 4. 3

Ans. 2

Explanation

$\sin^2 22^0 + \sin^2 68^0 + \cot^2 30^0 = \sin^2 22 + \sin^2 (90 - 22) + \cot^2 30$

$= \sin^2 22^0 + \cos^2 22 + + \cot^2 30$

$= 1 + 3 = 4.$ [$\because \cot 30° = \sqrt{3}$]

29. Find a simple discount equivalent to a discount series of 10%, 20% and 25%

1. 45% 2. 55% 3. 52% 4.46%

Ans. 4

Explanation

For the given sum,

The amount after successive discounts of 10%, 20% and 25% on a price, x :

= x × 0.9×0.8×0.75 = 0.54x;

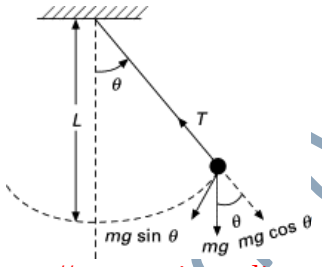
Hence, the simple discount will be equivalent = 46%.

30. The locus of a pendulum mass undergoing a simple harmonic motion can be graphically described as:

a) A sinusoidal curve b) A parabolic curve

c) A circle d) An ellipse

Ans: c.



Ref. https://www.sciencedirect.com/topics/engineering/simple-pendulum

31. Cost price of 100 books is equal to the selling price of 60 books. The gain or loss percentage will be:

1. 66 2/3% 2. 66 ¼% 3.66% 4. 66 ¾%

Ans.3

Explanation

CP of 100 books = SP of 60 books, i.e., by selling 60 books the cost price of 100 books is recovered and therefore the sale of balance 40 books is profit.

∴ Amount of profit is equal to selling price of balance 40 books

∴ Profit percentage = $\frac{40}{60} \times 100 = 66.66\%$

32. If 5 sinθ = 3, the numerical value of (secθ – tanθ) / (secθ + tanθ)

1.$\frac{1}{3}$ 2.$\frac{1}{2}$ 3.$\frac{1}{4}$ 4.$\frac{1}{5}$

Ans. 3

Explanation

$\sin\theta = 3/5$; $\cos\theta = 4/5$ and $\tan\theta = 3/4$;

By putting these values in the given equation-

$\sec\theta - \tan\theta = 5/4 - 3/4 = 1/2$;

$\sec\theta + \tan\theta = 5/4 + 3/4 = 2$; Hence, the required ratio = 1/4;

33. If 3/4 of a number is 7 more than 1/6 of the number, then 5/3 of the number is:

1. 15 2. 18 3. 12 4. 20

Ans. 4

Explanation

Let the number be x

Given: $\frac{3}{4}x = \frac{1}{6}x + 7 \rightarrow x = 12$;

Hence, the required answer, i.e., 5/3 of the number = $\frac{5}{3} \times 12 = 20$;

34. What is the arithmetic mean of first 20 odd natural numbers?

1. 17 2. 19 3. 22 4.20

Ans. 4

Explanation

Sum of first 20 odd natural numbers = n^2

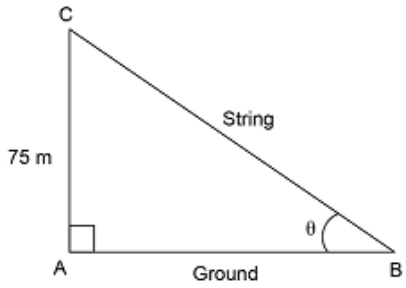
$\therefore$ Average = $\frac{n^2}{n} = n = 20$

35. A kite is flying at the height of 75m from the ground. The string makes an angle θ (where cot θ = 8/15) with the level ground. Assuming that there is no slack in the string, the length of the string is equal to:

1. 75m 2. 85m 3. 40m 4. 65m

Ans. 2.

Explanation



Given: cot θ $=\frac{8}{15}=\frac{AB}{AC}$

sin θ $=\frac{15}{17}=\frac{AC}{BC}$

String's length = 75/(15/17) = 85 m

36. In an examination, a student must get 36% marks to pass. A student who gets 190 marks failed by 35 marks. The total marks in that examination is:

1. 500 2.625 3 810 4. 450

Ans. 2

Explanation

Let the total marks in the examination be x;

Minimum marks to pass the examination = 0.36x;

Given: 0.36x = 190 + 35 → x = 225/0.36 = 625.

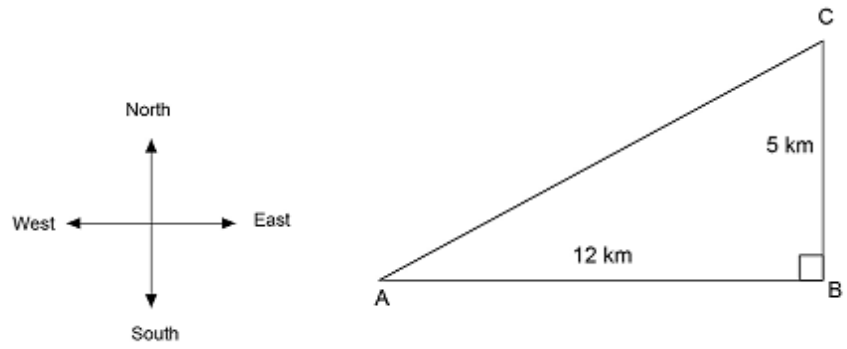
37. If a person travels from a point A towards east for 12 km and then travels 5km towards north and reaches a point C, then shortest distance from A to C is:

1. 14 2. 12 3. 17 4.13

Ans.4

Explanation

From the figure given below- we can find the shortest distance between the starting point and destination point using Pythagoras theorem = $\sqrt{(13)^2+(5)^2}$= 13 m



38. A train 180 m long is running at a speed of 90 km/h. How long will it take to pass a telephone post?

1. 8.2 secs 2. 7.8 secs 3. 8 secs 4. 7, 12 sec.

Ans. 4

Explanation

Train speed = 90 kmph = 90 x 5/18 = 25m/s

Time to pass a telephone post= Distance/ Speed

$= \frac{180}{25} = 7\frac{5}{25}\text{min} = 7min, \frac{5}{25}x\ 60\text{ sec} = 7\text{ min, }12\text{ sec.}$

39. An article which is marked at Rs. 975 is sold for Rs. 897. The % discount is?

1. 6% 2. 10% 3. 12% 4.8%

Ans. 4

Explanation

$\%\text{ discount} = \frac{975 - 897}{975} \times 100 = 8\%$

40. If sec θ + tan θ = p, (p ≠ 0) then sec θ is equal to

1. (p + 1/p), p ≠ 0 2. 1/2(p + 1/p), p ≠ 0

3. 2(p – 1/p), p ≠ 0 4. (p – 1/p), p ≠ 0

Ans. 2

Explanation

secθ + tanθ = p ……..(1)

∵ $sec^2\theta - tan^2\theta = 1 \rightarrow (sec\theta + tan\theta)(sec\theta - tan\theta) = 1$;

secθ – tanθ = 1/p ……..(2)

Add Eqn.(1) and Eqn.(2) → $\sec\theta = \frac{1}{2}(p + 1/p) = \frac{1}{2}\left(\frac{p^2+1}{p}\right)$ …….(3)

Note (additional sum): To find tan θ and sin θ

Subtract Eqn.(2) from Eqn.(1) → $\tan\theta = \frac{1}{2}(p - 1/p) = \frac{1}{2}\left(\frac{p^2-1}{p}\right)$ ……(4)

Divide Eqn.(4) by Eqn.(3) → $\sin\theta = \frac{p^2-1}{p^2+1}$

41. If p = 99 then the value of p ($p^2 + 3p + 3$)

1.999999 2. 988899 3. 989898 4. 998889

Ans. 1

Explanation

$= 99(99^2 + 3\times99 + 3)$;

$= 99\,[(100 -1)^2 + 3(100 – 1) +3]$;

$=99\,[10000 + 1 – 200 +300]$;$=99(10101) = 999999$;

42. If x = 2 then the value of $x^3 + 27x^2 + 243x + 631$

1.1233 2. 1231 3. 1321 4. 1211

Ans. 1

Explanation

Substitute x = 2 in the given equation,

$= (2)^3 + 27(2)^2 + 243(2) + 631$;

$= 8 + 108 + 486 + 631$;$= 1233$;

43. An office opens at 10 AM and closes at 5 PM. The lunch interval is 30 minutes. The ratio of lunch interval to the total period of office hours is

1. 1:7 2. 1:14 3. 7:1 4. 14:1

Ans. 2

Explanation

Total office hours = 7 hours= 7×60=420 minutes. Interval = 30 minutes

Hence, the required ratio= 30/420 = 1: 14;

45. If two numbers A and B are in the ratio 4:5 and the difference of their squares is 81, what is the value of A?

1. 36 2. 15 3. 45 4. 12

Ans. 1

Explanation

Let the first number A= 4x and second number B= 5x;

$25x^2 - 16x^2 = 81 \rightarrow x=9$;

Hence, the value of A = 36;

46. If two circles touch each other internally. The greater circle has its radius as 6 cm and the distance between the centers of the circles is 2 cm. The radius of the other circle is

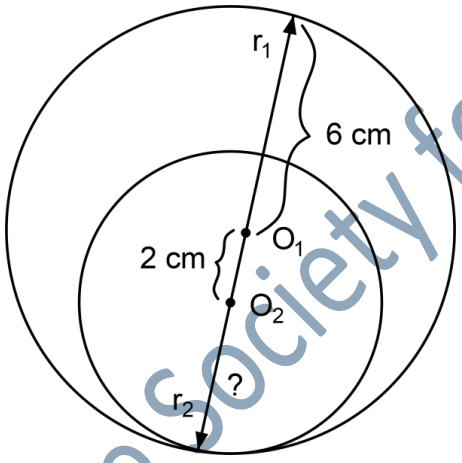
1. 3cm 2. 4cm 3. 2cm 4. 5 cm

Ans. 2

Explanation

O_1 is the center of the outer circle and O_2 is the center of inner circle. Both the centres are collinear and r_1=6 cm.

$\therefore r_1+2+r_2 = 12$ (equal to the diameter of outer circle) $\rightarrow r_2 = 4$cm.



47. The smallest fraction in the following is :$\frac{4}{5}, \frac{5}{6}, \frac{6}{7}, \frac{7}{8}$

(1) $\frac{7}{8}$ (2) $\frac{6}{7}$ (3) $\frac{5}{6}$ (4) $\frac{4}{5}$

Ans:4.

(If the numerator and denominator of a proper fraction differ by 1 and the numerator and denominator of successive fractions increase by 1, the fraction with minimum value of numerator and denominator is the smallest)

48. A bookseller allowed 15% discount on the books sold. Meena purchased books worth Rs.1500. How much will she has to pay to the bookseller?

1. Rs.1200 2. Rs.1250 3. Rs.1275 4. Rs.1300

Ans. 3

Explanation

For the book price of 100, one has to pay 85 after 15% discount (i.e., 100 – 15 = 85%)

The amountto be paid for the book cost of 15000 = 85% of 1500 = Rs. 1275.

49. If the ratio between the profit and sale price of an article is 1:5, then the ratio between the sale price and the cost price of that article is:

1. 3:2 2. 4:3 3. 5:4 4. 6:5

Ans. 3

Explanation

Cost Price = CP, Sale price =SP

Cost Price = Sale Price–Profit

Let profit be x →SP = 5x and therefore CP = 4x

Sale Price: Cost Price = 5: 4;

50. What percent of 1 day is 36 minutes?

1. 25% 2. 2.5% 3. 3.6% 4. 0.25%

Ans. 2

Explanation

1 day = 24 × 60 minutes = 1440 minutes;

The required percentage = $36\times\frac{100}{1440}$=2.5%.