Classic MoCAT 3
Explanatory Answer

1. Because all flies constantly fly perpendicular to another fly, they all travel the shortest distance to each other, which is 10 meter (all flies make a kind of spiral flight to the center of the square, and during this flight, the flies constantly form a square until they meet in the center). The flies all travel **10 meter**

2. In Envelope #14, there are:
81 Rs.100 bills = Rs.8100
1 Rs. 50 bill = Rs. 50
2 Rs. 20 bills = Rs. 40
1 Rs. 2 bill = Rs. 2
----- +
Rs.8192 (total amount of money for Envelope #14)
In Envelope #8, there are:
1 Rs.100 bill = Rs.100
1 Rs. 20 bill = Rs. 20
1 Rs. 5 bill = Rs. 5
1 Rs. 2 bill = Rs. 2
1 Rs. 1 bill = Rs. 1 <- that's the one!

Rs.128 (total amount of money for Envelope #8)

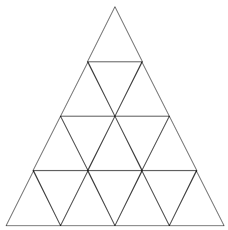
Envelope #2 has 1 Rs.2 bill in it, which is its total amount also.
Now Rs.8192 + Rs.128 + Rs.2 = Rs.8322. And that is the winning bid!
All money amounts in the envelopes are $2^{(\text{number of envelope - 1})}$.

3. There are four possible cases:
The traveler asks the question to the truth-telling brother, and the left road leads to village A. The truth-telling brother knows that his lying brother would say that the left road does not lead to village A, and so he answers "No".
The traveler asks the question to the truth-telling brother, and the right road leads to village A. The truth-telling brother knows that his lying brother would say that the left road leads to village A, and so he answers "Yes".
The traveler asks the question to the lying brother, and the left road leads to village A. The lying brother knows that his truth-telling brother would say that the left road leads to village A, and so he lies "No".
The traveler asks the question to the lying brother, and the right road leads to village A. The lying brother knows that his truth-telling brother would say that the left road does not lead to village A, and so he lies "Yes". Hence [1]

4. Every year 5 in a thousand, i.e. 0.5% of the dodos are eliminated from the population. In 100 years, 50% of the population will be eliminated.

5. Out of 64 cubes, 24 are painted 2 on the exactly two sides. Hence ratio = 3/8.

6. Total number of triangles = 16.

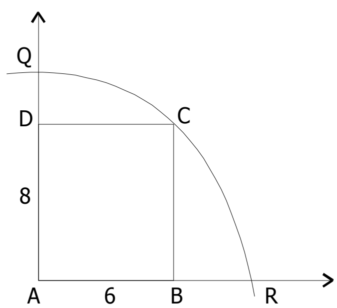


Area of one triangle = $\frac{\sqrt{3}}{4} \times 12 \times 12 = 36\sqrt{3}$ cm^2.

Total area = $16 \times 36\sqrt{3} = 576\sqrt{3}$ cm^2.

7. Let the man buy z shares.
$z(100 - x) = 4500$ and $(z - 10)(100 + x) = 6250$.
Solving we get $z = 60$.

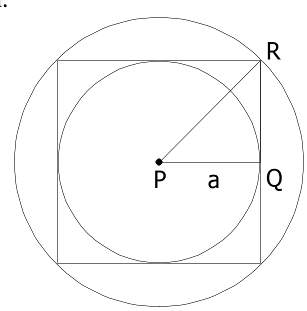
8.



If AB = 6 and AD = 8, then BC = $\sqrt{8^2 + 6^2} = 10$.

QR is 1/4th of the circumference of a circle whose centre is A. Hence, QR = $\frac{2\pi 10}{4} = 5\pi$.

9. The figure can be drawn as such.



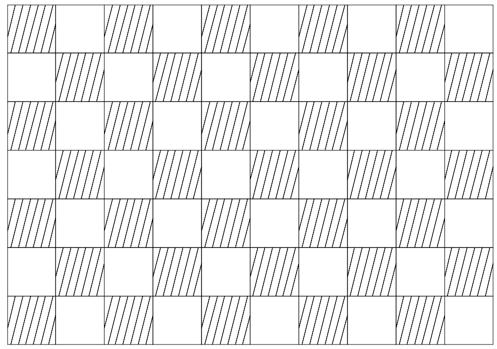
If radius of smaller circle = PQ = a, then QR = a and PR = $\sqrt{PQ^2 + QR^2} = \sqrt{a^2 + a^2} = a\sqrt{2}$.

Area of smaller circle $= \pi a^2$.

Area of bigger circle $= \pi(a)^2 = 2\pi a^2$.

Ratio of their areas = 1 : 2.

10. The canvas along the length would have 5 blue and 5 green squares for 1 inch breadth. Hence, they would have equal number of blue and green squares, similar to a chess board but with different proportions.



11. $x + y = 90^0$ and $y + z = 90^0 \Rightarrow x = z$.

12. Let x = 3 and y = 8. Then xy^2 is the largest value. Hence [2]

13. Total oil needed = 6 × 5 = 30 quarts = 7 gallons and 2 quarts.
∴ The cost of oil/quart is cheaper when you purchase by the gallon, he should buy at least 7 gallons of oil. However, in order to get the remaining 2 quarts, it is cheaper to buy 2 quarts individually rather than another gallon.
∴ The minimum amount = 7 × Rs.12 + 2 × Rs.5 = Rs.94.

14. $AD^2 = x^2 + y^2$

$\Delta\, ABC = \frac{1}{2}(y + z)x \qquad \therefore \Delta\; ABD = \frac{1}{4}(y + z)x = \frac{1}{2}\, xy$

or y = z. Again, $w^2 = (y + z)^2 + x^2 = 4y^2 + x^2$

or $w^2 - 3y^2 = x^2 + y^2$

or $AD^2 = w^2 - 3y^2$

15. From the given information, ABCD is a trapezium with CE as the altitude.

$\therefore$ Area $= \frac{1}{2}CE(BC + AD) = \frac{1}{2}e(b + d)$

16. If $a_n = 1$ then next entry $= (1 - 1)^2 = 0$.

If $a_n = 0$, then next entry $= (0 - 1)^2 = 1$.

If $a_n = 1$ then next entry $= (1 - 1)^2 = 0$.

17. If $x + y > 4$ and $x < 3$, then clearly $y > 1$.

18. The given equations is of the form $(x - \sqrt{3})\left(x - \sqrt{5}\right) + \sqrt{7} = 0$

The roots of the form $(x - \alpha)(x - \beta) = \sqrt{7}$

$\therefore -\alpha = -\sqrt{3} \Rightarrow \alpha = \sqrt{3}, \quad -\beta = -\sqrt{5} \Rightarrow \beta = \sqrt{5}$

Hence the answer is [2]

19. Let $P(x) = x^3 + ax^2 + bx + 6$
$P(+2) = (+2)^3 + a(+2)^2 + b(+2) + 6 = 0$
i.e $+ 8 + 4a + 2b + 6 = 0$
i.e $4a + 2b = -14$
i.e $2a + b = -7$ (1)
$P(+3) = (3)^3 + a(3)^2 + b(3) + 6 = 3$
i.e $+ 27 + 9a + 3b + 6 = 3$
i.e $9a + 3b = -30$
i.e $3a + b = -10$ (1)
eqn (1) and (2) gives
$-a = 3 \Rightarrow a = -3$
$\therefore b = -7 + 6 = -1$
Hence the answer is [3]

20. The sum areas of the squares is
If 'a' is the side of the original square then side 'b' of the square formed by joining the midpoints of the original square will be $b = \sqrt{\left[\frac{a}{2}\right]^2 + \left[\frac{a}{2}\right]^2}$ or $\frac{a}{\sqrt{2}}$ (By pythagoras theorem)
Similarly, side of the square next formed = $\frac{b}{\sqrt{2}} = \frac{a}{\sqrt{4}}$

Now, $S = 100^2 + \left(\frac{100}{\sqrt{2}}\right)^2 + \left(\frac{100}{\sqrt{4}}\right)^2 + \ldots\ldots\ldots\infty$

$$\therefore S\infty = 100^2\left[1 + \frac{1}{2} + \frac{1}{2^2} + \ldots.\infty\right]$$

$$= 100^2\left[\frac{1}{1-\frac{1}{2}}\right] = 100^2[2] = 2 \times 10000 = 20,000 \text{ cm}^2$$

Hence the answer is [1]

21. Given that a, A_1, A_2, b are in AP.
$\therefore A_1 = \frac{a + A_2}{2}$ and $A_2 = \frac{A_1 + b}{2}$

$\therefore A_1 + A_2 = \frac{a + A_2 + A_1 + b}{2}$

i.e $\frac{1}{2}(A_1 + A_2) = \frac{1}{2}(a + b)$

i.e $A_1 + A_2 = a + b$.

Also, a, G_1, G_2, b are in GP

$\therefore G_1^2 = aG_2$ and $G_2^2 = G_1 b$

$\therefore (G_1 G_2)^2 = aG_1G_2b$

$\Rightarrow G_1G_2 = ab$.

$\therefore \frac{A_1 + A_2}{G_1G_2} = \frac{a + b}{ab}$

Hence the answer is [2]

22. $2117 \times 1883 - 1113 \times 887$

$= \{(2000 + 117)(2000 - 117)\} - \{(1000 + 113)(1000 - 113)\}$

$= 2000^2 - 117^2 - 1000^2 + 113^2$

$= (2000^2 - 1000^2) - (117^2 - 113^2)$

$= (2000) + 1000)(2000 - 1000) - (117 + 113)(117 - 113)$

$= (3000 \times 1000) - (230)(4) = 2999080$

Hence the answer is [1]

23. We know $(x + y + z)^2 = x^2 + y^2 + z^2 + 2(xy + yz + zx)$

$\therefore\ 8^2 = 50 + 2(xy + yz + zx)$

$\therefore\ 64 = 50 + 2(xy + yz + zx)$

$\therefore\ 14 = 2(xy + yz + zx)$

$\Rightarrow xy + yz + zx = \frac{14}{2} = 7$

Hence the answer is [3]

24. Let c = number of chairs in a row, r = number of rows.

cr = 36.

We need to know how many ways we can write 36 as a product of 2 integers each greater than or equal to 3.

$36 = 1 \times 36,\ 2 \times 18,\ 3 \times 12,\ 4 \times 9,\ 6 \times 6,\ 9 \times 4,\ 12 \times 3,\ 18 \times 2$, and 36×1.

Of these, 5 i.e. ($3 \times 12,\ 4 \times 9,\ 6 \times 6,\ 9 \times 4,\ 12 \times 3$) satisfy the requirements.

25. $*9 = 2 \times 9 - 10 = 8$

$*8 = 2 \times 8 - 10 = 6$

$*6 = 2 \times 6 - 10 = 2$

26. $\frac{BD}{AD} = \frac{4}{3}$. $\therefore$ BD = 4x, AD = 3x

$\frac{AD}{DC} = \frac{5}{12}$. $\qquad \therefore$ AD = 5y, DC = 12y

$4x = 56 - 12y$ .... (i) and $3x = 5y$ .... (ii)

Solving (i) and (ii), x = 5, y = 3. $\qquad \therefore$ AD = 15, DC = 36

$\therefore\ AC^2 = 15^2 + 36^2 = 39^2$

27. Clearly to maximise $\frac{x^3z^2}{y}$, x should be 2, z should be -3, and y should be $\frac{1}{2}$.

Max $\frac{x^3z^2}{y} = 144$.

28. Height of pile A from the ground = $15 \times 7 + 95 = 200$ cm.

Height of pile B from the ground = $12 \times 8 + 100 = 196$ cm.

Height of pile C from the ground = $9 \times 12 + 90 = 198$ cm.

Height of pile D from the ground = $8 \times 11 + 110 = 198$ cm.

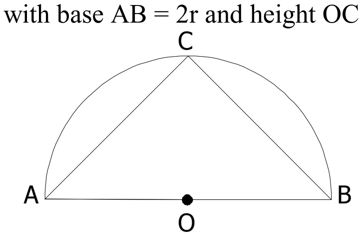
Excluding the top book, the height of piles A, B, C, and D are 193 cm, 188 cm, 186 cm, and 187 cm respectively. Hence, no two piles are at the same height from the ground.

29. Referring to solution of Q.28, we note that pile A is the highest from the ground (excluding the top book in each pile).

30. Referring to solution of Q.28, we note that piles C and D are at the same height from the ground.

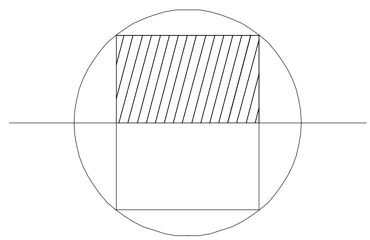
31. In each case his percentage profit = 4.5.

32. Triangle ABC is right angled with base AB = 2r and height OC = r.



$\therefore$ T = $\frac{1}{2} \times 2r \times r = r^2$

The largest rectangle contained in a semicircle is half of the largest square contained in a full circle. The diagonal of the square is the diameter of the circle.



$\therefore$ The area of the square= $2r^2$.

$\therefore$ R = $\frac{2r^2}{2} = r^2$

$\therefore$Hence, T = R.

33. $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$

$\therefore \frac{200 \times 250}{100} = \frac{300 \times 400}{T}$ ➔ $T = \frac{300 \times 400 \times 100}{200 \times 250} = 240$

34. Income = 4x and 5x.
Expenses = 7y and 8y.
Savings = 1000 and 2000.
$\therefore$ 4x – 7y = 1000 and 5x – 8y = 2000
Solving, x = 2000 and 9x = 18,000.

35. After first round, cask holds 8 gallons of water and rest milk.
Suppose its volume is x gallons in total.

$\therefore$ Now when 6 gallons are taken out, amount of water taken out is $6 \times \frac{8}{x}$.

$\therefore$ Final volume of water = $8 - \frac{48}{x} + 6$.

$\therefore 14 - \frac{48}{x} = \frac{x}{2}$ ➔ x = 24

36. The cost (C) = F + qv, where F is the fixed component, q is the number of units produced and v the variable cost per component.

$\therefore$ Sales price = $1.2 \times \frac{C}{q} = 1.2\left(\frac{F}{q}\right) + 1.2v$

$120 = 1.2\left(\frac{F}{250}\right) + 1.2v$ or $100 = \left(\frac{F}{250}\right) + v \Rightarrow 25{,}000 = F + 250v$ .... (i)

and $96 = 1.2\frac{F}{500} + 1.2v$ or $80 = \frac{F}{500} + v \Rightarrow 40{,}000 = F + 500v$ .... (ii)

By (ii) – (i),

$\therefore 250v = 15{,}000 \Rightarrow 500v = 300{,}000$

$\therefore F + 1000v = 40{,}000 + 30{,}000 = 70{,}000$

$\therefore$ Sales price of 1000 units = $1.2\left(\frac{F}{1000}\right) + 1.2v = 1.2 \times 70 = 84$

37. $a + \frac{1}{b} = 1 \Rightarrow \frac{1}{a} = \frac{1}{1-\frac{1}{b}} = \frac{b}{b-1}$

$b + \frac{1}{c} = 1 \Rightarrow c = \frac{1}{1-b}$

$\therefore c + \frac{1}{a} = \frac{1}{1-b} - \frac{b}{1-b} = 1$

Also, $abc = \left(\frac{b-1}{b}\right) b\left(\frac{1}{1-b}\right) = -1.$

$c + \frac{1}{a} + abc = 1 - 1 = 0$

38. Let the 3 sides be a, b, and $\sqrt{a^2 + b^2}$

$ab = 300$ .... (i)

$a + b + \sqrt{a^2 + b^2} = 60$ .... (ii)

Solving (i) and (ii), we have the sides as 15, 20, and 25.

Note: This is easier solved by observation of the given options by checking for pythogorian triplets.

39. The pipes are arranged length-wise side by side, with two pipes joined end-to-end covering the entire length of the box. One face can accommodate $\frac{20}{2} \times \frac{20}{2} = 100$ pipes.

Total number of pipes = 100 × 2 = 200.

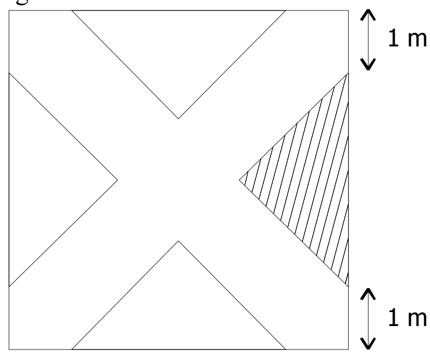
However, in this arrangement, there is space between the pipes. Hence, if on the second layer, if 9 pipes are kept over the 10 pipes of the first layer, there is saving in height. Overall in 20 c.m., two extra layers can be fitted in. Hence, number of layers is 12, with 6 layers of 10 pipes and 6 of 9 pipes. Total = 114. Total number of pipes will be 114 × 2 = 228.

40. Unless we know the amount we cannot derive the answer.

41. $x = 7 - 4\sqrt{3} = (2 - \sqrt{3})^2$

$\therefore \sqrt{x} + \frac{1}{\sqrt{x}} = 2 - \sqrt{3} + \frac{1}{2-\sqrt{3}} = (2 - \sqrt{3}) + (2 + \sqrt{3}) = 4$

42. The path is actually one central square, 4 rectangles from its 4 sides and 1 right angled isosceles triangle capping each rectangle.



$\therefore$ Hypotenuse of the triangle = $\sqrt{2}$ m. $\therefore$ Side of the triangle = 1 m.

Now, the park without the path consists of 4 right angled isosceles triangles (one of them shaded in the figure above), whose hypotenuse is (20 – 2 × 1) m = 18 m.

Area of shaded region = $\frac{1}{2} \times (\text{side})^2 = \frac{1}{2} \times \frac{18^2}{2}$.

Required area = $4 \times \frac{1}{2} \times \frac{1}{2} \times 18^2 = 324$ m^2.

43. The triangle has to be equilateral.

$\therefore$ Each of its sides = $\sqrt{36\sqrt{3} \times \frac{4}{\sqrt{3}}} = 12$ m.

$\therefore$ Its perimeter = 12 × 3 = 36 m.

44. The only such possible Pythagoras triplet is 15, 20, 25.
Now, all 3 sides are 20 cm.

Area of the right angled triangle = $\frac{1}{2} \times 15 \times 20 = 150$ cm^2.

45. $\angle ADB = \angle DBE - \angle DAE = \frac{1}{2}\angle CBE - \frac{1}{2}\angle CAE = \frac{1}{2}\angle ACB = 20$

46. $f(x + 2) - f(2) = 12$
$\Rightarrow 2(x + 2)^2 + b(x + 2) + c - (2 \times x^2 + b \times x + c) = 12$
$\Rightarrow 2[(2x + 2).2] + 2b = 12 \times 8(x + 1) + 2b = 12$
This cannot be solved unless b is known.

47. The lateral surface area of the cone is equal to the area of the semicircle is $\frac{1}{2} \times \pi r^2$.

The perimeter of the base is equal to the curved portion of the circumference of the semicircle, which is π r.

$\therefore$ If the radius of the base is ‘r’, then 2πr’ = πr $\Rightarrow$ r’ = $\frac{r}{2}$.

$\therefore$ Area of base = $\frac{\pi r^2}{4}$.

$\therefore$ Total surface area = $\frac{\pi r^2}{2} + \frac{\pi r^2}{4} = \frac{3}{4} \times \frac{22}{7} \times 7 \times 7 = 115.5$ cm^2.

48. x is odd and y is even
$\therefore$ (x + 1) y = even × even = even
(x – 1) (y + 1) = even × odd = even
(x + 1) (y –1) = even × odd = even
x (y – 1) = odd × odd = odd
Hence the answer is [3]

49. Total sale proceeds = 100(12.3 + 37.4 + 28.6 + 21.7) = Rs.10,000;
Total purchase price = 100(20 + 19.5 + 27.5 + 26) = Rs.9,300 Net profit = Rs.10000 - Rs.9300 = Rs.700

50. Given that one in each row is left blank, then that one in each column is left blank is superfluous information. Same with wrong answers: Maximum score = 25
Not attempted= 5; Incorrect= 5; $\therefore$ Net score = 15

101 to 104

After getting the following seating arrangement, all questions can be answered.

D	C	F
B	E	A

For questions 105 to 110:

105. Profits = (selling price – cost price) volumes
Profits for different years are

1991	14,000	**1994**	6,000
1992	10,800	**1995**	4,000
1993	11,200	**1996**	4,800

Answer is [a].

106. Cost/sales = $\frac{\text{cost price}}{\text{sales price}}$

Lowest for 1991 and equal to $\frac{100}{200}$ = 0.5

Answer is [a].

107. From All, decrease in profits = 6,000 - 4,000 = 2,000. Answer is [b].

108. Price growth percentage in 1996 = $\frac{240 - 210}{210} \times 100 = \frac{100}{7}$

Price in 1997 = $240 + \frac{100}{7} \times \frac{240}{100} = 274.3$

Answer is [c].

109. It is in 1992 and equal to $\left(\frac{150 - 100}{100}\right) \times 100 = 50\%$. Answer is [a].

For questions 110 to 114:

110. 12% of 40 = 4.8 lac sets

Answer if [c].

111. The percentage MS of philips is $\dfrac{0.36 \times 40 + 0.3 \times 25}{40 + 25} = 33.8\%$

Answer is [c].

112. Number of Panasonic sold in 1990 = $0.1 \times 15 = 1.5$

Number of Panasonic sold in 1995 = $0.05 \times 40 = 2.00$

$\therefore$ Increase = 33%.

Answer is [c].

113. The total price realisation in 1990 = $2{,}000 \times (0.1 \times 15)$

The total price realisation in 1995 = $3{,}000 \times (0.2 \times 40)$

Percentage increase in turnover = (240 – 30)/30 = 700%

Answer is [d].

114. TV imported in 1995 = $0.3 \times 25 = 7.5$ lac

Music system imported in 1995 = $0.1 \times 40 = 4$ lac

Greater by 3.5 lac

Answer is [a].

115. Total Indians surveyed in the 61000 - 150000 category = 420.
Of these, number who invest in debentures = 240
$\therefore$ Desired number = 420 - 240 = 180

116. In the < 60000 category among resident Indians 120 – 30 + 90 – 30 invest in shares only or debentures only.
In the NRI category, 90 – 45 + 60 – 45 invest in one of the two. Total = 150 + 60 = 210

117. Total investors with income over 150000 = 1080
Number who invest = 150 + 120 – 90 + 120 + 150 – 60 = 290
% of those who do not invest = (1080 – 390) / 1080 = 64%

118. From the previous question, it is 390.

119. From statement (A), a + b = 2a - 2c, i.e. a = b + 2c (1)
From statement (B), a + b = 3a + 3c, i.e. 2a = b - 3c (2)
Nothing can be said individually about b and c respectively except when both the statements are put together.
(1) x 2 gives 2a = 2b + 4c (3)
Now comparing (2) and (3), we have 2b + 4c = b - 3c i.e. b = -7c. Since b, c $\geq$ 0; b = c = 0. Thus b is not greater than c. Both statements are necessary. Answer is (3).

120. Let's first start counting the prime numbers viz. 2, 3, 5, 7, 11, 13, 17, 19, 23, ...
From statement (A), the prime numbers required are 11, 13, 17, 19 and 23.
The second statement can give rise to various combinations. Answer is (1)

121. Reading the question carefully would give us the value of 'q' to be known for us to get the answer.
20 x 3 < 65. Answer is (1)

122. From statement (a), p, q, r and s are positive integers which gives no clue about p + q + r + s being equal to 4 or not.
Statement (B) gives us the product of p, q, r, s to be 1. But the sum of these numbers can only equal 4 if all of them are positive. Combining both (A) and (B), p + q + r + s = 4. Answer is (3)

123. Statement (A) gives a relation of 4 variables from which it is not possible to find if a > b or not. Statement (B) only talks about the relationship between 'x' and 'y' i.e. x = 4y. Combining (A) and (B), = 4. Here y may be +ve or -ve, thus leaving an indeterminate relation between a and b. Answer is (4)

124. The first statement does not tell us the proportion of Fiats to Ambassadors towed away. Similarly the second statement does not give any information on the break-up / proportion of white coloured cars among Fiats and Ambassadors. Information from the above statements has not helped us in determining the answer. Answer is (4).

125. From statement (A), $a_1 = a_3 = a_5 = a_7 = ... a_{odd} = 5$. This does not tell us the value of a_{24} . From statement (B), $a_2 = a_4 = a_6 = ... a_{even} = -5$. Thus $a_{24} = -5$. Answer is (2)

126. The information of statement (A) is a tautology. A regular hexagon would have its vertices on the circle if its central/main diagonal is the diameter of the circle.
From statement (B), $pr^2 = p(a)$ i.e. $r^2 = a$.
This can only be the case when r = a = 1.
Answer is (2).

140. Total Sales = Average Sales × No. of Outlets. This is highest for Crossword (90×12 = 1080) for 2002.

141. Profitability was least for Fountainhead for 2003 measured as 50 / 420 = approx 12%

142. Profitability was highest for Gangarams for 2003 measured as 200 / 540 = approx 37%

143. % Increase in Profit per outlet was highest for Crossword in 2003. It grew from 10 per outlet to 18 per outlet, an increase of 80%.

144. % Increase in Sales = 200 / 340 and Percentage increase in profits = 75 / 125. Ratio is closest to 1:1

145. Market leader in 2002 is Crossword.
Crossword sales per outlet increased from 90 to 120, i.e. 33.33%.
If its profits of 2002, i.e. 120 had increased by 33.33 %, it would have become 160. Hence it would have led to a decrease in profits, compared to the actual value.

146-150

First let us get actual price of share A for the 6 sessions.
Session 1 = 230 – 120 = 110
Session 2 = 340 – 230 = 110
Session 3 = 480 – 340 = 140
Session 4 = 560 – 480 = 80
Session 5 = 700 – 560 = 140
Session 6 = 810 – 700 = 110

146. Maximum Percentage change was from Session 4 to 5, i.e. 60/80 = 75%
147. Cannot be determined as the 1 : 1 ratio could be 1 and 1 or 2 and 2 or 3 and 3…..
148. In session 2, 7 shares have gone up. That is the maximum. In session 1 and 6, maximum 5 could have gone up, in session 5, maximum 6 could have gone up, and in session 3, again maximum 6 could have gone up.
149. The maximum decline was in Session 4, i.e. of 5 shares.
150. From the table above, it is clear that the highest price was at 140 for session 3 and 5.