QUANTITATIVE ABILITY - 76 (SOLUTION)

1. (B) The easiest way to solve such problems for examination puposes is trial and error or by back substituting answers in the choices given.

$101^2 = 10201$

$101^2 - 1 = 10200$

This is divisible by 100.

Similarly try for $101^3 - 1 = 1030301 - 1 = 1030300$

So, you can safely conclude that $(101^1 - 1)$ to $(101^9 - 1)$ will be divisible by 100.

$(101^{10} - 1)$ to $(101^{99} - 1)$ will be divisible by 1000.

Therefore, $(101^{100} - 1)$ will be divisible by 10000.

2. (C) Let the number of days that they holidayed be equal to T.

Then, they practiced Yoga on (T – 24) mornings.

They played tennis on (T – 12) evenings.

As they did not do both the activities together on any single day.

Days on which they had any activity = Number of days they practiced Yoga + Number of days they played tennis

$22 = T - 24 + T - 12$

$22 + 24 + 12 = 2T$

$58 = 2T$

$T = 29$

3. (D) The value of the discriminant of a quadratic equation will determine the nature of the roots of a quadratic equation.

The discriminant of a quadratic equation $ax^2 + bx + c = 0$ is given by $b^2 - 4ac$.

- If the value of the discriminant is positive, i.e. than 0, then the roots of the quadratic equation will be real.
- If the value of the discriminant is 0, then the roots of the quadratic equation will be real and equal.
- If the value of the discriminant is negative, i.e. lesser than 0, then the roots of the quadratic equation will be imaginary. The two roots will be complex conjugates of the form p + iq and p – iq.

Using this basic information, we can solve this problem as shown below.

In this question,

$a = 2$, $b = 2(p + 1)$ and $c = p$

Therefore, the discriminant will be $[2(p + l)]^2 - 4x\ 2xp = 4(p + l)^2 - 8p$

$= 4[(p + l)^2 - 2p]$

$= 4[(p^2 + 2p + l) - 2p]$

$= 4(p^2 + l)$

For any real value of p, $4(p^2 + 1)$ will always be positive as p^2 cannot be negative for real p.

Hence, the discriminant $b^2 - 4ac$ will always be positive.

When the discriminant is greater than 0 or is positive, then the roots of a quadratic equation will be real.

4. (A) Let the value of certificates purchased in the first year be ₹ a.
The difference between the value of the certificates is ₹ 300 (d = 300).
Since, it follows Arithmetic Progression, the total value of certificates after 20 years is given by

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

$$83000 = \frac{20}{2}\left[2a + (20-1)300\right]$$

83000 = 10(2a + 5700)
2a + 5700 = 8300
a = ₹ 1300
The value of the certificates purchased by him in 13th year = a + (n – l)d
= 1300 + (13 – l) × 300 = ₹ 4900

5. (D) Raghav completes 40% of work in 12 days, i.e. another 60% of the work has to be completed by Raghav and Ravi. They have taken 12 days to complete 60% of work.

Therefore, Raghav and Ravi, working together, would have completed the work in $\frac{12}{60} \times 100$ = 20 days

As Raghav completes 40% of the work in 12 days, he will take $\frac{12}{40} \times 100$ = 30 days

To complete the enitre work. Working alone, we know Raghav takes 30 days to complete the enitre work. Let us assume that Ravi takes x days to complete the entire work, if he works alone and together they complete the entire work in 20 days.
Therefore,

$$\frac{1}{30} + \frac{1}{x} = \frac{1}{20}$$

$$\frac{1}{x} = \frac{1}{20} - \frac{1}{30}$$

$$\frac{1}{x} = \frac{1}{60}$$

Therefore, Ravi will take 60 days to complete the work, if he works alone.
Hence, Raghav is 100% more efficient than Ravi.

6. (B) Let x m^3/min be the filling capacity of the pump.
Therefore, the emptying capacity of the pump will be (x +10) m^3/min.

The time taken to fill the tank = $\frac{3600}{x}$

The time taken to empty the tank = $\frac{3600}{x+10}$

We know that it takes 12 more minutes to fill the tank than to empty it.

$$\frac{3600}{x} - \frac{3600}{x+10} = 12$$

$3600x + 36000 - 3600x = 12(x^2 + 10x)$

$36000 = 12(x^2 + 10x)$

$3000 = x^2 + 10x$

$x^2 + 10x - 3000 = 0$

$(x + 60)(x - 50) = 0$

$x = -60$ or $x = 50$ (ignore the negative value of $x = -60$)

Therefore, emptying capacity of the pump = 50 + 10 = 60 m^3/min

7. (D) The smallest number in the series is 1000, a 4-digits number.
The largest number in the series is 4000, the only 4-digits number to start with 4.
The left most digit (thousands place) of each of the 4 digits numbers other than 4000 can take one of the 3 values 1 or 2 or 3.
The next 3 digits (hundreds, tens and units place) can take any of the 5 values 0 or 1 or 2 or 3 or 4.
Hence, there are 3 × 5 × 5 × 5 = 375 numbers from 1000 to 3999.
Including 4000, there will be 376 such numbers.

8. (D) Wrong calculated marks = 35 × 72 = 2520

Correct average = $\frac{2520 - 36 + 86}{35} = \frac{2570}{35} = 73.42$

9. (C) If a container contains y units of liquid and x units of liquids is taken out. If this operation is repeated n times.

The final quantity of the acid in the container = $y\left(1 - \frac{x}{y}\right)^n$

$$24 = 54\left(1 - \frac{x}{54}\right)^2$$

$$\left(1 - \frac{x}{54}\right)^2 = \frac{24}{54} = \frac{4}{9}$$

$$\left(1 - \frac{x}{54}\right) = \frac{2}{3}$$

$$\frac{x}{54} = \frac{1}{3}$$

$x = 18$ litres

10. (B) $S_n = 0.4 + 0.44 + 0.444 + \ldots +$ to n terms
$= 4[0.1 + 0.11 + 0.111 + \ldots +$ to n terms]

$$= \frac{4}{9}[0.9 + 0.99 + 0.999 + \ldots + \text{to n terms}]$$

$$= \frac{4}{9}\left[\frac{9}{10} + \frac{99}{100} + \frac{999}{1000} + \ldots + \text{to n term}\right]$$

$$= \frac{4}{9}\left(1 - \frac{1}{10}\right) + \left(1 - \frac{1}{100}\right) + \left(1 - \frac{1}{1000}\right) + \ldots\ldots + \left(1 - \frac{1}{10^n}\right)$$

$$= \frac{4}{9}\left[(1 + 1 \ldots\ldots + n\,\text{times}) - \left(\frac{1}{10} + \frac{1}{100} + \frac{1}{1000} + \ldots\ldots + \frac{1}{10^n}\right)\right]$$

$$= \frac{4}{9}\left[n - \frac{\frac{1}{10}\left\{1-\left(\frac{1}{10}\right)^n\right\}}{1-\frac{1}{10}}\right] \qquad \left[\therefore S_n = \frac{a(1-r^n)}{(1-r)}\right]$$

$$= \frac{4}{9}\left[n - \frac{\frac{1}{10}\left(1-\frac{1}{10^n}\right)}{\frac{9}{10}}\right] = \frac{4}{9}\left[n - \frac{1}{9}\left(1-\frac{1}{10^n}\right)\right]$$

$$= \frac{4}{9}\left[9n - 1 + \frac{1}{10^n}\right]$$

11. (B) Let his increased income be x.

ATQ,

$$(x - 1200) \times \frac{80}{100} \times \frac{12}{100} = x \times \frac{80}{100} \times \frac{10}{100}$$

$12x - 14400 = 10x$

$x = ₹\ 7200$

12. (D) Let the present value of what A owes to B be ₹ x

ATQ,

$$x + \frac{x \times 14 \times 3}{2 \times 100} = 1573$$

$$x + \frac{21}{100}x = 1573$$

$$\frac{121x}{100} = 1573$$

$\therefore$ $x = ₹\ 1300$

Let y be the present value of what B owes A.

ATQ,

$$y + y \times \frac{1}{2} \times \frac{14}{100} = ₹\ 1444.50$$

$$y + \frac{7}{100}y = ₹\ 1444.50$$

$$y = \frac{1444.50 \times 100}{107} = ₹\ 1350$$

Hence, B pay ₹ 50 to A.

13. (A) Let the amount given at 4% per annum be ₹ x

$\therefore$ Amount given at 5% per annum = ₹ $(1200 - x)$

ATQ,

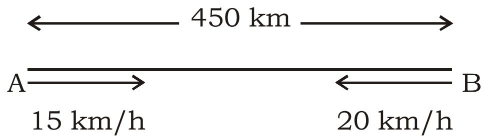
$$\frac{x \times 4 \times 2}{100} + \frac{(1200 - x) \times 5 \times 2}{100} = 110$$

$$\frac{-2x + 12000}{100} = 110$$

x = ₹ 500

Also, $(1200 - x) = 1200 - 500$ = ₹ 700

14. (A) Let the time of meet = t h



ATQ,

$$15\left(t - \frac{20}{60}\right) + 20t = 450$$

t = 13 hours

$$\text{Distance from A} = 15\left(13 + \frac{1}{3}\right) = 190 \text{ km}$$

15. (A) Speed of Ramesh = $3x$ km/hr

Speed of Suresh = $4x$ km/hr

Let the distance = D

ATQ,

$$\frac{D}{3x} - \frac{D}{4x} = \frac{1}{2}$$

$$\frac{D}{x}\left(\frac{1}{12}\right) = \frac{1}{2}$$

D = $6x$

$$\text{Time of Ramesh} = \frac{D}{3x} = \frac{6x}{3x} = 2 \text{ hours}$$

$$\text{Time of Suresh} = \frac{D}{4x} = \frac{6x}{4x} = 1.5 \text{ hours}$$

16. (A) ATQ,

A – 10 = B + 10

A – B = 20 .... (i)

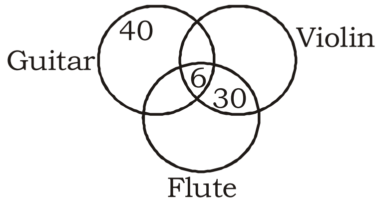
And A + 20 = 2(B – 20)

A – 2B = –60 .... (ii)

From equations (i) and (ii),

A = 100 and B = 80

17. (B)



∴ Required number of musician = 120 – (40 + 6 + 30) = 44

18. (D) Let weight of diamond = x

From question,

Initial cost of diamond = kx^2

where k = constant

Let the weights of 4 pieces be y, $2y$, $3y$, $4y$ respectively.

ATQ,

$x = y + 2y + 3y + 4y$

$x = 10y$ ....(i)

Again, from question,

$ky^2 + k(2y)^2 + k(3y)^2 + k(4y)^2 = 140000$

$30\ ky^2 = 140000$

$30k\dfrac{x^2}{100} = 140000$ [using (i)]

$kx^2 = \dfrac{140000 \times 100}{30}$

kx^2 = ₹ 4.7 lakh (approx.)

∴ Initial cost of diamond = ₹ 4.7 Lakh

19. (A) Let the number of male and female participants at the start of seminar be $3x$ and x respectively.

ATQ,

$\dfrac{3x - 16}{x + 6} = \dfrac{2}{1}$

$3x - 16 = 2x + 12$

$x = 28$

∴ Total number of participants at the start of seminar = $3x + x$

= 4 × 28 = 112

20. (B) Let the speed of train on onward journey be x km/h.

Then, the speed of train on return journey = 0.8 x km/h.

Total time = $\dfrac{500}{x} + \dfrac{1}{2} + \dfrac{500}{0.8x}$

$23 = \dfrac{1125}{x} + \dfrac{1}{2}$

$x = 1125 \times \dfrac{2}{45} = 50$ km/h

∴ Speed of train on return journey = 50 × 0.8 = 40 km/h

21. (A) Let P and M denote Pintu and Mintu respectively.

Case I :

$P + n = 4(M - n)$

$P - 4M = -5n$ ... (i)

Case II :

$(P - n) = 3(M + n)$

$P - 3M = 4n$ ... (ii)

Solving equations (i) and (ii), we get

$M = 9n$ and $P = 31n$

Put $n = 1$, we get $P = 31$

22. (A) Together both pipes can fill the tank in $\left(\frac{20 \times 30}{20 + 30}\right)$ = 12 hours

One third tank can be filled in 4 hours

Now, there is a leak which can empty the tank in (12 × 4)h = 48 hours

So, two-third tank can be filled in $\frac{2}{3} \times \left(\frac{12 \times 48}{48 - 12}\right) = 10\frac{2}{3}$ hours

So, total time to fill the tank = $4 + 10\frac{2}{3} = 14\frac{2}{3}$ hours

23. (A) Let the quantity of hematite mined be x kg.

ATQ,

Pure Iron = 8000 kg

ATQ,

$x \times \frac{80}{100} \times \frac{25}{100} = 80000$

$\therefore\ x = \frac{80000 \times 100 \times 100}{80 \times 25} = 400000$ kg

24. (D) Let his sales were x.

Then,

$1000 + \frac{2.5}{100}(x - 4000) = \frac{5}{100}x + 600$

$2.5x = 30000$

x = ₹ 12000

25. (A) Quantity of alcohol in 1 litre mixture of first bottle = $\frac{2}{10} \times 1 = \frac{1}{5}$ litre

As second bottle does not contains alcohol.

So, required fraction = $\frac{1}{3} \times \frac{1}{5} = \frac{1}{15}$ litre

26. (C) Let the man purchased x pairs of brown socks.

Price of black socks and brown socks be ₹ $2a$ and ₹ a per pair respectively.

ATQ,

$\therefore \frac{3}{2}(4 \times 2a + x \times a) = x \times 2a + 4 \times a$

$12a + \frac{3}{2}xa = 2xa + 4a$

$12 + \frac{3}{2}x = 2x + 4$

$\frac{x}{2} = 8$

$x = 16$

$\therefore$ Required ratio = $\frac{4}{16}$ = 1 : 4

27. (B) Let 'a' be first term and d be the common difference.

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

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

And $S_{3n} = \frac{3n}{2}[2a + (3n - 1)d]$

Given, $S_{2n} = 3S_n$

$\therefore \frac{2n}{2}[2a + (2n - 1)d] = 3\frac{n}{2}[2a + (n - 1)d]$

$4a + (4n - 2)d = 6a + (3n - 3)d$

$d(4n - 2 - 3n + 3) = 2a$

$d = \frac{2a}{n+1}$

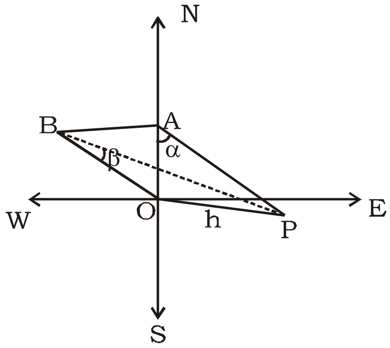
$\therefore S_n = \frac{2an^2}{n+1}$

And $S_{3n} = \frac{12an^2}{n+1}$

$\therefore \frac{S_n}{S_{3n}} = \frac{12an^2}{n+1} \times \frac{n+1}{12an^2} = \frac{1}{6}$

$\frac{S_{3n}}{S_n} = 6$

28. (A)



In ΔOAP,

$\tan\alpha = \frac{h}{OA}$

$OA = h\cot\alpha$

In ΔOBP,

$\tan\beta = \frac{h}{OB}$

$OB = h\cot\beta$

Now, In ΔOAB,

$OB^2 = OA^2 + AB^2$

$AB^2 = OB^2 - OA^2$

$AB^2 = h^2\cot^2\beta - h^2\cot^2\alpha$

$AB^2 = h^2[\cot^2\beta - \cot^2\alpha]$

$AB^2 = h^2[(\text{cosec}^2\beta - 1) - (\text{cosec}^2\alpha - 1]$

$AB^2 = h^2[\text{cosec}^2\beta - \text{cosec}^2\alpha]1$

$AB^2 = h^2\left\{\frac{\sin^2\alpha - \sin^2\beta}{\sin^2\alpha\sin^2\beta}\right\}$

$\therefore\ h = \frac{AB\sin\alpha\sin\beta}{\sqrt{\sin^2\alpha - \sin^2\beta}}$

29. (B) $\sec\theta + \tan\theta = P$

$(\sec\theta + \tan\theta)^2 = P^2$ (on squaring)

$\left(\frac{1+\sin\theta}{\cos\theta}\right)^2 = P^2$

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

$\frac{1+\sin\theta}{1-\sin\theta} = P^2$

Applying componendo and dividendo,

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

$$\frac{2}{2\sin\theta} = \frac{P^2-1}{P^2+1}$$

$$\sin\theta = \frac{P^2+1}{P^2-1}$$

30. (A) $\sin\theta + \cos\theta = \sqrt{2}\cos\theta$

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

$$\cot\theta = \frac{1}{\sqrt{2}-1} \times \frac{\sqrt{2}+1}{\sqrt{2}+1} = \sqrt{2}+1$$

31. (B) $a^{\frac{1}{3}} + b^{\frac{1}{3}} + c^{\frac{1}{3}} = 0$

$a^{\frac{1}{3}} + b^{\frac{1}{3}} = -c^{\frac{1}{3}}$

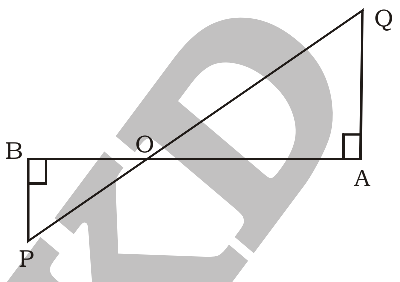
$$\left(a^{\frac{1}{3}} + b^{\frac{1}{3}}\right)^3 = \left(-c^{\frac{1}{3}}\right)^3$$

$$a+b+3a^{\frac{1}{3}}.b^{\frac{1}{3}}\left(a^{\frac{1}{3}} + b^{\frac{1}{3}}\right) = -c$$

$a + b + c = 3a^{\frac{1}{3}}.b^{\frac{1}{3}}.c^{\frac{1}{3}}$

$(a + b + c)^3 = 27abc$

32. (A)



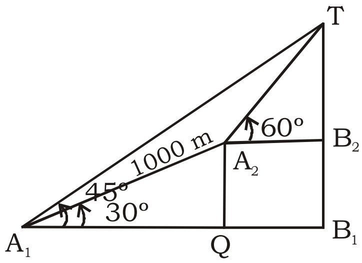
$\Delta POB \sim \Delta QOA$

$$\frac{ar(\Delta POB)}{ar(\Delta QOA)} = \frac{PO^2}{QO^2}$$

$$\frac{150}{ar(\Delta QOA)} = \frac{5^2}{7^2}$$

$$\therefore \quad ar(\Delta QOA) = \frac{150 \times 49}{25} = 294 \text{ cm}^2$$

33. (A)



A_1A_2 = 1000 m = 1 km and

$\angle A_2A_1B_1 = 30°$

$\angle TA_2B_2 = 60°$

In ΔA_1A_2Q,

$$\sin 30° = \frac{A_2Q}{A_1A_2}$$

$$\therefore\ A_2Q = \frac{1}{2} \times 1 = \frac{1}{2} \text{ km} = B_2B_1 \quad ......(i)$$

$$\cos 30° = \frac{A_1Q}{A_1A_2}$$

$$A_1Q = \frac{\sqrt{3}}{2} \times 1 = \frac{\sqrt{3}}{2} \text{ km} \quad ......(ii)$$

In ΔTB_1B_2,

$$\tan 45° = \frac{TB_1}{A_1B_1} = \frac{x}{A_1B_1} \quad ......(iii)$$

In ΔTA_2B_2,

$$\tan 60° = \frac{TB_2}{A_2B_2} = \frac{TB_1 - B_2B_1}{QB_1} = \frac{TB_1 - B_2B_1}{A_1B_1 - A_1Q}$$

$$\sqrt{3} = \frac{x - \frac{1}{2}}{x - \frac{\sqrt{3}}{2}} \quad \text{[From (i), (ii) and (iii)]}$$

x = 1.366 km

34. (A) Volume of water in the reservoir = 0.075 × 0.055 × 18 × 30 × 60 = 133.65 m^3

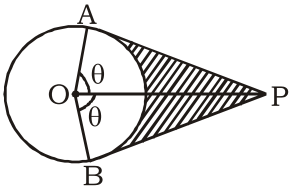
Now,

Volume = Area × height

133.65 = 10.3 × 3.75 × h

$$\therefore\ h = \frac{133.65}{10.8 \times 3.75} = 3.3 \text{ m}$$

35. (A)



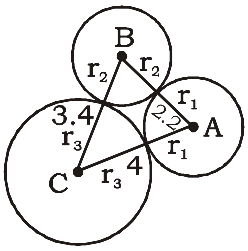
$\cos\theta = \frac{5}{10} = \frac{1}{2}$

$\therefore$ $\theta = 60^\circ$

Now, reflex $\angle AOB = 360^\circ - 120^\circ = 240^\circ$

Now, length of the belt $= \frac{\pi r\theta}{180^\circ} = \frac{\pi \times 5 \times 240^\circ}{180^\circ} = \frac{20\pi}{3}$ cm

36. (B) Let r_1, r_2 and r_3 be the radii of three circles.



$r_1 + r_2 = 2.2$ ...... (i)

$r_2 + r_3 = 3.2$ ...... (ii)

$r_1 + r_3 = 4.0$ ...... (iii)

Adding equations (i), (ii) and (iii)

$2(r_1 + r_2 + r_3) = 9.6$

$r_1 + r_2 + r_3 = 4.8$

$\therefore$ $r_3 = (4.8 - 2.2) = 2.6$

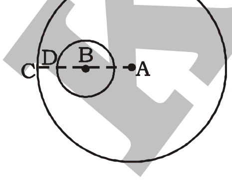
$r_1 = (4.8 - 3.4) = 1.4$

$r_2 = (4.8 - 4.0) = 0.8$

$\therefore$ The diameter are 2 × 1.4 = 2.8, 2 × 0.8 = 1.6 and 2 × 2.6 = 5.2

37. (D) Given, $AC = \frac{a}{2}$

$BD = \frac{b}{2}$ and CD = c



Then,

$AB = AC - BC = \frac{a}{2} - (BD + CD)$

$= \frac{a}{2} - \frac{b}{2} - c = \frac{1}{2}(a - b) - c$

38. (B) Interest earns from first scheme = $\frac{1500 \times 5 \times 14}{100}$ = ` 1050

$\therefore$ Amount = 1500 + 1050 = ₹ 2550

Interest earns after 2 years at compound interest = ₹ 1408

$$R = 20\% = \frac{1}{5} \Rightarrow \begin{array}{cc} 5 & 6 \\ \times 5 & \times 6 \\ \hline 25 & 36 \end{array}$$

C.I = 36 – 25 = 11

11 unit → 1408

25 unit → $\frac{1408}{11} \times 25$ = ₹ 3200

$\therefore$ Required additional money = 3200 – 2550 = ₹ 650

39. (A) Area of walls = $2(l + b) \times h = 2(8 + 6) \times 3 = 84\ m^2$

Area of two windows and a door = $2\left(1\frac{1}{2} \times 1\right) + \left(2 \times 1\frac{1}{2}\right) = 6\ m^2$

Area to be covered = 84 – 6 = 78 m^2

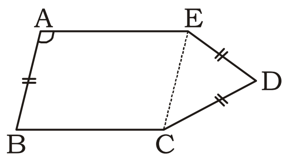
Area of paper = Area to be covered = 78

$(l \times b)$ of paper = 78

Length of paper = $\frac{78}{50} \times 100$ m = 156 m

$\therefore$ Required cost = $\frac{156 \times 25}{100}$ = ₹ 39

40. (B)



∠BCE = 102°, AB = CD = ED (given)

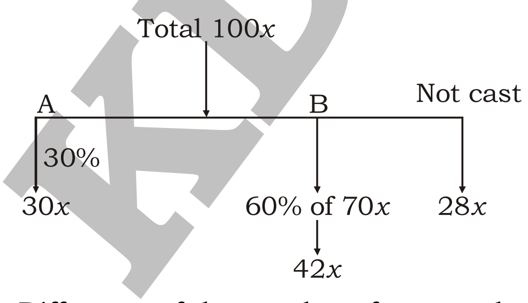
CD = ED = CE [∵ AB = CE]

ΔECD is an equilateral triangle.

$\therefore$ ∠ECD = 60°

∠BCD = 102° + 60° = 162°

41. (C) Let the total number of Voters = $100x$



Difference of the number of voters who vote for A and who did not cast their vote

= $30x - 28x = 2x$

ATQ,

$2x = 1200$

$x = 600$

$\therefore$ Total number of voters = 100 × 600 = 60,000

42. (B) Let x be the maximum marks.

ATQ,

28% of x + 12 = 30% of x + 6

2% of x = 6

Maximum marks $x = \frac{6}{2} \times 100 = 300$

Passing marks = $\frac{30}{100} \times 300 + 6 = 96$

43. (A) $10\% = \frac{1}{10}$, $20\% = \frac{1}{5}$, $25\% = \frac{1}{4}$

	I	II	III
CP	$10_{\times 2}$	$5_{\times 3}$	$4_{\times 6}$
SP	$9_{\times 2}$	$6_{\times 3}$	$3_{\times 6}$
P/L	$-1_{\times 2}$	$+1_{\times 3}$	$-1_{\times 6}$

ATQ,

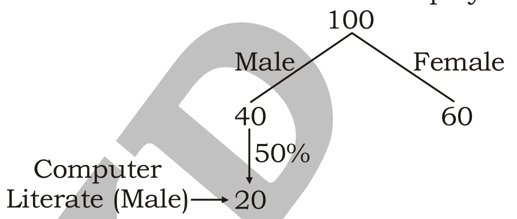
SP is same in both cases

So Average C.P. = $\frac{(20+15+24)}{3} = \frac{59}{3}$

Average S.P. = $\frac{(18+18+18)}{3} = \frac{54}{3}$

Required percentage = $\frac{\left(\frac{59}{3} - \frac{54}{3}\right)}{\frac{54}{3}} \times 100 = 9.256\%$ higher

44. (B) Let the total no. of employees be



Total percentage of male computer literate = 20%

Total percentage of female computer literate = 62% – 20% = 42%

Hence number of female literates = $\frac{42}{100} \times 1600 = 672$

45. (A) Volume of remaining solid = $\frac{2}{3}\pi r^2 h$

$= \frac{2}{3}\pi \times 6 \times 6 \times 10 = 240\pi\ cm^3$

46. (A) $\tan^2\alpha = 1 + 2\tan^2\beta$

$\sec^2\alpha - 1 = 1 + 2(\sec^2\beta - 1)$

$\sec^2\alpha - 1 = 2\sec^2\beta - 1$

$$\frac{1}{\cos^2\alpha} = \frac{2}{\cos^2\beta}$$

$\sqrt{2}\cos\alpha = \cos\beta$

$\therefore \sqrt{2}\cos\alpha - \cos\beta = 0$

47. (A) $\sin 3A = \cos(A - 26°)$

$\cos(90° - 3A) = \cos(A - 26°)$

$90° - 3A = A - 26°$

$90° + 26° = 3A + A$

$4A = 116$

$A = \frac{116}{4} = 29°$

48. (B) Length of arc = 40 cm

Subtended angle = $22\frac{1°}{2}$

Radius = $\frac{40 \times 180}{22\frac{1}{2} \times 3.14}$ = 102 cm

49. (A) Required average = $\frac{3297 + 2523 + 2860 + 2660 + 2770 + 2665 + 2899}{7} = \frac{19674}{7}$

= \$ 2810.57 million $\approx$ \$ 2811 million

50. (B) Required average value = $\frac{3034 + 3210 + 3106 + 3200 + 2984}{5}$

= $\frac{15534}{5}$ = \$ 3106.8 million

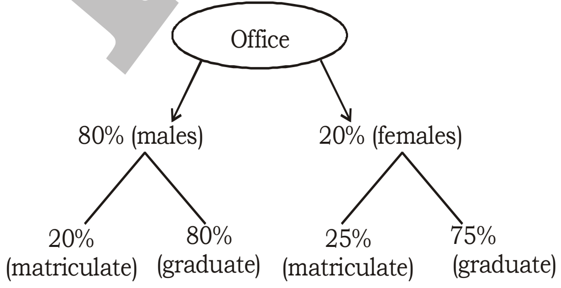
51. (D) Required % = $\frac{(2860 - 2523)}{2523} \times 100\%$ = 13.35%

52. (B) Required change in trade gap = $\frac{(2770 - 2665)}{2770} \times 100\%$ = 3.79% decrease

53. (A) Required difference = (3464+3034+3210) – (3106 + 3200 + 2984)

= 9708 – 9290 = 418

54. (B)



20% of total = 600

$x = \frac{600 \times 100}{20} = 3000$

Total graduates = 80% of 80% of 3000 + 75% of 20% of 3000

$= \frac{80 \times 80 \times 3000}{100 \times 100} + \frac{75 \times 20}{100 \times 100} \times 3000$

= 1920 + 450 = 2370

55. (C) $x = \frac{z(b-c)(b+c-2a)}{(a-b)(a+b-2c)}$

$y = \frac{z(c-a)(c+a-2b)}{(a-b)(a+b-2c)}$

$x + y = \frac{z(b-c)(b+c-2a)(c-a)(c+a-2b)}{(a-b)(a+b-2c)}$

$= \frac{z\left(b^2 + bc - 2ab - bc - c^2 + 2ac + c^2 + ac - 2bc - ac - a^2 + 2ab\right)}{(a-b)(a+b-2c)}$

$= \frac{z(b^2 - a^2 - 2bc + 2ac)}{(a-b)(a+b-2c)}$

$= \frac{z[(b-a)(b+a) - 2c(b-a)]}{(a-b)(a+b-2c)}$

$= \frac{z(b-a)(a+b-2c)}{(a-b)(a+b-2c)} = -z$

$\therefore$ $x + y + z = 0$

56. (A) $x+y+z = 6$ ....(i)

$xy+yz+zx = 11$ ....(ii)

$x^3 + y^3 + z^3 - 3xyz = (x + y + z) \{x^2 + y^2 + z^2 - (xy + yz + zx)\}$ ....(iii)

From equation (i)

$(x+y+z)^2 = 36$

$x^2 + y^2 + z^2 + 2(xy + yz + zx) = 36$

$x^2 + y^2 + z^2 + 2 \times 11 = 36$ [using (ii)]

$x^2 + y^2 + z^2 = 36 - 22$

$x^2 + y^2 + z^2 = 14$ ....(iv)

using (i), (ii), (iv) in (iii), we get

$x^2 + y^2 + z^2 - 3xyz = 6\ (14 - 11) = 6 \times 3 = 18$

57. (D) P : Q : R = 24000 : 33000 : 48000 = 24 : 33 : 48 = 8 : 11 : 16

Let total profit = x

ATQ,

$\frac{7x}{8} \times \frac{8}{35} + \frac{x}{8} =$ ₹390

$x =$ ₹ 1200

58. (A) Let maximum score = x

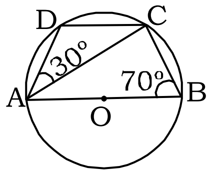
Minimum score = $x - 172$

Now, From question

$40 \times 50 - (x + x - 172) = 38 \times 48$

$x = 174$

59. (A)



In Cyclic quadrilateral ABCD,

$\angle ADC + \angle ABC = 180°$

$\angle ADC + 70° = 180°$

$\angle ADC = 110°$ ....(i)

Now, in $\triangle ADC$

$\angle CAD + \angle ADC + \angle ACD = 180°$

$30° + 110° + \angle ACD = 180°$ [using (i)]

$\angle ACD = 40°$

60. (B) $\cos x = \dfrac{2\cos y - 1}{2 - \cos y}$

$\cos y = \dfrac{2\cos x + 1}{2 + \cos x}$

Now, $\tan\dfrac{x}{2}\ \cot\dfrac{y}{2} = \dfrac{\sin\frac{x}{2}.\cos\frac{y}{2}}{\cos\frac{x}{2}.\sin\frac{y}{2}} = \dfrac{\sqrt{1-\cos x}}{\sqrt{1+\cos x}} \times \dfrac{\sqrt{1+\cos y}}{\sqrt{1-\cos y}}$

$\dfrac{\sqrt{1-\cos x}}{\sqrt{1+\cos x}} \times \dfrac{\sqrt{1+\dfrac{2\cos x+1}{2+\cos x}}}{\sqrt{1-\dfrac{2\cos x+1}{2+\cos x}}}$

$\dfrac{\sqrt{1-\cos x}}{\sqrt{1+\cos x}} \times \dfrac{\sqrt{3\cos x+3}}{\sqrt{1-\cos x}}$

$\dfrac{\sqrt{1-\cos x}}{\sqrt{1+\cos x}} \times \sqrt{3}\dfrac{\sqrt{1+\cos x}}{\sqrt{1-\cos x}}$

$\therefore\ \sqrt{3} \times 1 = \sqrt{3}$

61. (D) $\sin\theta = 3\sin(\theta+2\alpha)$

$$\frac{\sin\theta}{\sin(\theta+2\alpha)} = \frac{3}{1}$$

$$\frac{\sin\theta+\sin(\theta+2\alpha)}{\sin\theta-\sin(\theta+2\alpha)} = \frac{3+1}{3-1}$$

$$\frac{2\sin(\theta+\alpha)\cos\alpha}{2\cos(\theta+\alpha)\sin(-\alpha)} = \frac{4}{2}$$

$$\tan(\theta+\alpha).\left(-\frac{1}{\tan\alpha}\right) = 2$$

$$\tan(\theta+\alpha) = -2\tan\alpha$$

$$\tan(\theta+\alpha)+2\tan\alpha = 0$$

62. (C) $\sin^2\alpha + \sin^2\beta - \sin^2\gamma$

$$\frac{1-\cos2\alpha}{2} + \frac{1-\cos2\beta}{2} - \sin^2\gamma$$

$$1 - \frac{1}{2}[\cos 2\alpha + \cos 2\beta] - \sin^2\gamma$$

$$1 - \frac{1}{2}[2\cos(\alpha+\beta)\cos(\alpha-\beta)] - (1-\cos^2\gamma)$$

$$1 - [\cos(\pi+\gamma)\cos(\alpha-\beta)] - 1 + \cos^2\gamma$$

$$\cos\gamma\ \cos(\alpha-\beta) + \cos^2\gamma$$

$$\cos\gamma[\cos(\alpha-\beta) + \cos(\pi-\overline{\alpha+\beta})]$$

$$\cos\gamma[\cos(\alpha-\beta) - \cos(\alpha+\beta)]$$

$$\cos\gamma \times 2\sin\alpha\sin\beta$$

$$2\sin\alpha\sin\beta\cos\gamma$$

63. (C) Given,

$x = a(b-c)$
$y = b(c-a)$
$z = c(a-b)$

then, $\left(\frac{x}{a}\right)^3 + \left(\frac{y}{b}\right)^3 + \left(\frac{z}{c}\right)^3$

$= (b-c)^3 + (c-a)^3 + (a-b)^3$

$= 3.(b-c)(c-a)(a-b)$ $\quad [\because (b-c) + (c-a) + (a-b) = 0]$

$= 3.\left(\frac{x}{a}\right)\left(\frac{y}{b}\right)\left(\frac{z}{c}\right) = \frac{3xyz}{abc}$

64. (D) $\sin^6\theta + \sin^4\theta.\cos^2\theta - \sin^2\theta.\cos^4\theta - \cos^6\theta$

$= \sin^6\theta + \sin^4\theta(1-\sin^2\theta) - (1-\cos^2\theta)\cos^4\theta - \cos^6\theta$

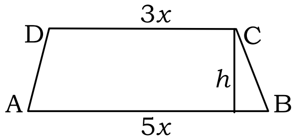
$= \sin^6\theta + \sin^4\theta - \sin^6\theta - \cos^4\theta + \cos^6\theta - \cos^6\theta$

$= \sin^4\theta - \cos^4\theta$

$= (\sin^2\theta + cso^2\theta)(\sin^2\theta - cso^2\theta)$

$= \sin^2\theta - \cos^2\theta$

65. (A)



Area of the trapezium = 1440 m^2

h = 24 m

$a = 3x$

$b = 5x$

$a + b = 8x$

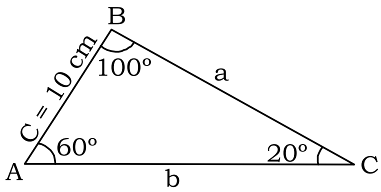
$\therefore$ area = $\frac{1}{2} \times (a+b) \times h = 1440$

$\frac{1}{2} \times 8x \times 24 = 1440$

$x = 15$

Length of longer parallel side = $5x = 5 \times 15 = 75$ m

66. (C)



$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

$$\frac{\sin 100^\circ}{AC} = \frac{\sin 20^\circ}{10}$$

$\therefore$ AC = $\frac{10 \sin 100^\circ}{\sin 20^\circ}$

67. (B) Diameter of the iron ball = 14 cm

$\therefore$ radius r_1 = 7 cm

Let the radius of base of cylinder = r_2

Given, height of cylinder = $2\frac{1}{3} = \frac{7}{3}$ cm

From question, $\frac{4}{3}\pi r_1^{\,3} = \pi r_2^2 h$

$\frac{4}{3} r_1^3 = r_2^2 . h$

$\frac{4}{3} . (7)^3 = r_2^2 \times \frac{7}{3}$

r_2 = 14 cm

Diameter = 28 cm

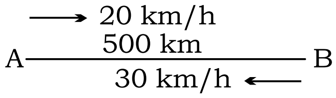
68. (B) r = 18 m

Area of circle = $\pi(18)^2 = 324\pi$ sqm.

Area of flower bed = $324\pi - (18-3)^2\pi$

$= 324\pi - 225\pi = 99\pi$ sq. m.

69. (B)



Let the both train will meet after time 't'

then,

$20 \times t + 30 \times t = 500$

$(20 + 30)t = 500$

$t = 10h$

∴ The distance of crossing point of the two trains From A = $20 \times t = 20 \times 10 = 200$ km

70. (D) Here, $a = 10$ L, $n = 2$ and $x = 100$L

∴ Quantity of wine in end = $x\left(1-\frac{a}{x}\right)^n$

$= 100\left(1-\frac{10}{100}\right)^2 = 81$L

∴ Required ratio = 81: (100 – 81) = 81 : 19

71. (A) Let the smaller number = x and the greater number = y

ATQ,

$\left(y-\frac{x}{2}\right) = 4\left(x-\frac{x}{2}\right)$

$y - \frac{x}{2} = 4\frac{x}{2} \Rightarrow y = 2x + \frac{x}{2}$

$y = \frac{5x}{2}$

∴ $y : x = 5 : 2$

72. (D) Let the numbers of men, women and children are 3y, 2y and y and their wages are $5x$, $3x$ and $2x$ respectively.

Given,

3y = 90

y = 30

Number of women = 60 and

Number of children = 30

ATQ,

Total daily wages = ₹ 10350

$90 \times 5x + 60 \times 3x + 30 \times 2x = 10350$

$x(450 + 180 + 60) = 10350$

$x = \frac{10350}{690} = 15$

∴ Daily wage of a man = 15 × 5 = ₹ 75

73. (C) Let the savings of A and B are 4x, 5x and the share in cost of gift are 3y, 4y respectively.
ATQ,

For A, $4x - 3y = \frac{2}{3} \times 4x$

$x = \frac{9y}{4}$ ....(i)

For B, $5x - 4y = 145$

$5 \times \frac{9y}{4} - 4y = 145$ [From equation (i)]

$y = 20$

∴ Cost of gift = $3y + 4y = 7 \times 20 =$ ₹ 140

74. (D) Let the fixed charges = ₹ x and the additional charges = ₹y / km
According to the question,
$x + 5y = 350$ ....(i)
$x + 20y = 800$ ....(ii)
On solving equations (i) and (ii), we get
$x = 200,\ y = 30$
∴ Charge for a distance of 30 km = $x + 25y = 200 + 30 \times 25 =$ ₹ 950

75. (D) If points are collinear then area will be zero

Area = $\frac{1}{2}\left|(x_A - x_C)(y_B - y_A) - (x_A - x_B)(y_C - y_A)\right|$

$(x_A - x_C)(y_B - y_A) = (x_A - x_B)(y_C - y_A)$

(2 – 6) (K – 3) = (2 – 4) (–3 –3)

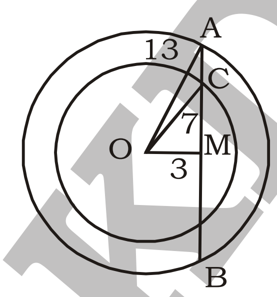
–4(K – 3) = (–2) × (–6)

K – 3 = $\frac{12}{-4}$

K – 3 = – 3

K = 0

76. (D) From figure



In Δ OCM, $CM^2 = 7^2 - 3^2 = 40$

∴ CM = $2\sqrt{10}$ cm

In Δ AOM,

AM = $\sqrt{13^2 - 3^2} = 4\sqrt{10}$

Now, AC = AM – CM = $2\sqrt{10}$ cm

77. (C) Let first pipe can fill the tank in x h.
Second pipe can fill the tank in $(x - 5)$ h
Third pipe can fill the tank in $(x - 9)$ h
ATQ,

$$\frac{1}{x} + \frac{1}{x-5} = \frac{1}{x-9}$$

$$\frac{x \times (x-5)}{x + x - 5} = x - 9$$

$x^2 - 5x = 2x^2 - 23x + 45$
$(x - 15)(x - 3) = 0$
$x = 15$ hours as $x = 3$ hours is not possible.

78. (D) Let the speed of train be x km/h.
As both the persons are walking in the same direction of train.
So, $(x - 4.5) \times 8.4 = (x - 5.4) \times 8.5$
$0.1x = 8.1$
$x = 81$ km/h

79. (C) Let Ram's monthly income be ₹ x.

Total savings = $x \times \frac{80}{100} \times \frac{85}{100} \times \frac{70}{100}$

$x = 9520 \times \frac{100}{80} \times \frac{100}{85} \times \frac{100}{70}$ = ₹ 20000

80. (B) Let they make x pieces per day.

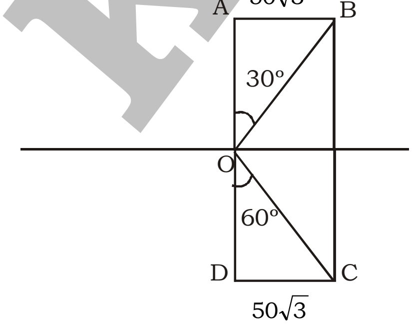
Then, $\frac{360}{x} - \frac{360}{x+4} = 1$

$$360\left[\frac{4}{x(x+4)}\right] = 1$$

$x(x + 4) = 1440 = 36 \times 40$
$x = 36$

$\therefore$ Required number of days = $\frac{360}{36}$ = 10 days

81. (B) BC = AD
Distance = BC
In ΔAOB,



$\tan 30° = \frac{50\sqrt{3}}{AO}$

$\frac{1}{\sqrt{3}} = \frac{50\sqrt{3}}{AO}$

AO = 150 m

AD = 300 m

Speed = $\frac{300}{2}$ = 50 m/min

= $\frac{5}{2}$ m/s = 9 km/h

82. (B) Let the shortest side be x m.

The hypotenuse = $(2x + 3)$m

Let third side = y m

$\therefore$ $x + y + 2x + 3 = 6x$

$\therefore$ $y = (3x - 3)$ m

Now, $(x)^2 + (3x - 3)^2 = (2x + 3)^2$

$x^2 + 9x^2 + 9 - 18x = 4x^2 + 9 + 12x$

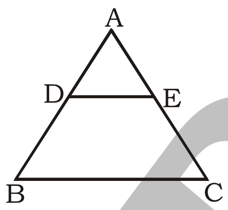
$6x^2 - 30x = 0$

$\therefore$ $x = 5$ m

$x \neq 0$

Three sides are 5 m, 12 m and 13 m.

83. (D) DE || BC (given)



$\because$ ΔADE and ΔABC are similar.

$\frac{ar(ADE)}{ar(ABC)} = \left(\frac{AD}{AB}\right)^2$

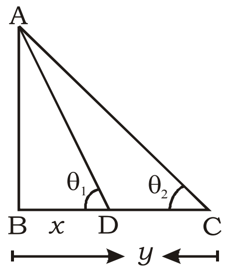
$\sqrt{\frac{1}{2}} = \frac{AD}{AB}$

$\frac{AD}{AB} = \sqrt{\frac{1}{2}}$

$\therefore$ $\frac{AD}{BD} = \frac{1}{\sqrt{2}-1} = 1 : \sqrt{2} - 1$

84. (C) $\theta_1 + \theta_2 = 90°$

$\theta_2 = 90° - \theta_1$



In ΔABC,

$\tan\theta_1 = \frac{AB}{BD}$

$\tan\theta_1 = \frac{AB}{x}$ .... (i)

In ΔABC,

$\tan\theta_2 = \frac{AB}{y}$

$\tan(90 - \theta_1) = \frac{AB}{y}$

$\cot\theta_1 = \frac{AB}{y}$

$\tan\theta_1 = \frac{y}{AB}$ ....(ii)

From equation (i) and (ii),

$\frac{AB}{x} = \frac{y}{AB}$

$(AB)^2 = xy$

$AB = \sqrt{xy}$

85. (A) Difference = $8.6 \times \frac{22}{100} - 5.4 \times \frac{15}{100}$

= 1.892 – 0.81 = 1.082 lakh = 108200

86. (D) $C_{2000} = 5.4 \times \frac{10}{100} = 0.54$ lakh

$C_{2010} = 8.6 \times \frac{8}{100} = 0.688$

$\therefore$ Required average = $\frac{0.54 + 0.688}{2} = \frac{1.228}{2}$ lakh = 61400

87. (C) Sum = $5.4 \times \frac{8}{100} + 8.6 \times \frac{18}{100} = 0.432 + 1.548 = 1.98$ lakh

88. (D) Total number of vacancies in 2010 = $\frac{48000 \times 100}{6} = 800000$

$\therefore$ Vacancies in city B = 20% of 800000 = 160000 = 1.60 lakh

89. (A) $C_{2000} = 5.4 \times \frac{10}{100} = 0.54$ lakh

$C_{2010} = 8.6 \times \frac{8}{100} = 0.688$ lakh

$\therefore$ % rise = $\left(\frac{0.688 - 0.54}{0.54}\right) \times 100 = 27.407\% \approx 27.41\%$

90. (B) The total score of 3 toppers = 123 × 120 – 120 ×118.5 = 540

The highest possible score of the third highest topper is possible when the score of other two toppers was minimum.

So,

$$\left.\begin{array}{l} I^{st} \text{ rankers score} = 187 (\text{minimum}) \\ 2^{nd} \text{ rankers score} = 186 (\text{minimum}) \\ 3^{rd} \text{ rankers score} = 167 (\text{miximum}) \end{array}\right\} 540$$

91. (B) Here the ratio of mixtures (i.e. milk and water) does not matter. But the important point is that whether the total amount (either pure or mixture) being transferred is equal or not. Since the total amount (i.e. 5 cups) being transferred from each one to another.

Hence A = B

92. (B) Let the percentage marks in Quantitative Aptitude = (10 a + b)%

Let the percentage marks in Reasoning = (10 b + a)%

Let the percentage marks in English = x%

ATQ,

$$\frac{(10a + b) + x + (10b + a)}{3} = x$$

11a + 11b + x = 3x

$$x = \frac{11}{2}(a + b)$$

Thus the percentage of the English section is a multiple of 11, i.e. 66%.

93. (C) CP SP MP

500 576 900

Again, $SP = MP\left[\left(1-\frac{r}{100}\right)^2\right]$ $[r \rightarrow \text{rate of discount in }\%]$

$576 = 900\left(1-\frac{r}{100}\right)^2$

$\frac{24}{30} = \left(1-\frac{r}{100}\right)$

r = 20%

Again, new SP = MP $\left(1+\frac{r}{100}\right)^2$

$= 900\left(1+\frac{20}{100}\right)^2 = 1296$

New, Profit percentage = $\frac{SP-CP}{CP}\times 100$

$= \frac{1296-500}{500}\times 100 = 159.2\%$

94. (C) Go through the option. Consider choice (C).

Efficiency of first worker = 5%

Efficiency of second worker = 4%

In 7 hours first worker completed 35% work

In 5 hours second worker completed 20% work

Thus,

Work completed = 55%

Remaining work = 45%

Hence, one condition is satisfied.

Again, they will take 5 more hours to complete 45% work

$\left[\frac{45}{4+5} = 5\right]$

Thus, first person completes 7 × 5 + 5 × 5 = 60% work

and second person completes 5 × 4 + 5 × 4 = 40% work

Hence, second condition is also satisfied.

95. (D) Actually they create a difference of 3 min per hour and the watches are showing a difference of 66 minutes. Thus they must have been corrected 22 hours earlier.

Now, the correct time can be found by comparing any one of the watch.

Since, second watch gains 1 min in 1 hour so it will must show 22 minutes extra than the correct time in 22 hours.

Hence, the correct time can be found by subtracting 22 min from 10 : 06, i.e. 9 : 44 am.

96. (D) $\frac{I_Q}{E_Q} = 1.05$

$\frac{I_P}{E_P} = 0.75$

$\therefore$ Required % = $\frac{1.05}{0.75} \times 100 = 140\%$

97. (D)

98. (A) The ratio of imports to exports is the same for Company P in the year 2007 and Company Q in the year 2004, then the sum of their imports will be

$(I_P + I_Q) = 0.8 \times (E_P + E_Q) = 0.8 \times 180 = 144$ lakh

99. (D) $\frac{I_P}{E_P} = 0.75$

$I_P = 0.75 \times E_P = 0.75 \times 120 = 90$ lakh

$\frac{I_Q}{E_Q} = 0.6$

$E_Q = \frac{I_Q}{0.6} = \frac{120}{0.6} = 200$ lakh

Required difference = 200 – 90 = 110 lakh

100. (A) $\frac{I_P}{E_P} = 0.5$

$E_P = \frac{I_P}{0.5} = \frac{80}{0.5} = 160$ lakh

$\frac{I_Q}{E_Q} = 1.2$

$I_Q = 1.2 \times 60 = 72$ lakh

Required% = $\frac{72}{160} \times 100 = 45\%$

QUANTITATIVE ABILITY - 76 (ANSWER KEY)

1.	(B)	26.	(C)	51.	(D)	76.	(D)
2.	(C)	27.	(B)	52.	(B)	77.	(C)
3.	(D)	28.	(A)	53.	(A)	78.	(D)
4.	(A)	29.	(B)	54.	(B)	79.	(C)
5.	(D)	30.	(A)	55.	(C)	80.	(B)
6.	(B)	31.	(B)	56.	(A)	81.	(B)
7.	(D)	32.	(A)	57.	(D)	82.	(B)
8.	(D)	33.	(A)	58.	(A)	83.	(D)
9.	(C)	34.	(A)	59.	(A)	84.	(C)
10.	(B)	35.	(A)	60.	(B)	85.	(A)
11.	(B)	36.	(B)	61.	(D)	86.	(D)
12.	(D)	37.	(D)	62.	(C)	87.	(C)
13.	(A)	38.	(B)	63.	(C)	88.	(D)
14.	(A)	39.	(A)	64.	(D)	89.	(A)
15.	(A)	40.	(B)	65.	(A)	90.	(B)
16.	(A)	41.	(C)	66.	(C)	91.	(B)
17.	(B)	42.	(B)	67.	(B)	92.	(B)
18.	(D)	43.	(A)	68.	(B)	93.	(C)
19.	(A)	44.	(B)	69.	(B)	94.	(C)
20.	(B)	45.	(A)	70.	(D)	95.	(D)
21.	(A)	46.	(A)	71.	(A)	96.	(D)
22.	(A)	47.	(A)	72.	(D)	97.	(D)
23.	(A)	48.	(B)	73.	(C)	98.	(A)
24.	(D)	49.	(A)	74.	(D)	99.	(D)
25.	(A)	50.	(B)	75.	(D)	100.	(A)