QUANTITATIVE ABILITY - 78 (SOLUTION)

1. (B) $(m^2 + n^2 + 16^2)\,k = 1$ and $16 \times 29k = 1$

$m^2 + n^2 + 16^2 = 16 \times 29$

$m^2 + n^2 = 16(29 - 16) = 16 \times 13 = 208$

Now the last digits of m, n cannot be (0, 8), (1, 7), (2, 6), (3, 5).

Therefore it can only be (4, 4) or (9, 9).

On checking, we find $m^2 + n^2 = 12^2 + 8^2$

Therefore, they can together do the work in

$$\frac{1}{(m+n+16)k} = \frac{16.29}{(12+8+16)} = \frac{16.29}{36}$$

$$= \frac{4.29}{9} = 4(3 + 0.22) = 12.88 \cong 13 \text{ days}$$

2. (B) Total population of town = 15 × $\frac{\text{Number of males}}{\text{Number of females}} = \frac{7}{8}$

Number of males and females = $7x$ and $8x$

Number of male children = 25% of $7x$

ATQ,

$$\frac{25}{100} \times 7x = 1.75x$$

Number of female children = 20% of $8x = \frac{20}{100} \times 8x = 1.6x$

Number of adult females = $8x - 1.6x = 6.4x$

$6.4x = 235200$

$$x = \frac{235200}{6.4} = 36750$$

Total population of town = 15 × 36750 = 551250

3. (A) Let Initial investments = 3x , 5x and 7x

After one year

$(3x - 45600) : 5x : (7x + 337600) = 24 : 59 : 167$

$$\frac{3x - 45600}{5x} = \frac{24}{59}$$

$x = 47200$

Initial investment of A = 47200 × 3 = ₹ 141600

4. (A) Let the total monthly sales of companies A and B be ₹ $2x$ and ₹ $3x$ and their total monthly expenditure be ₹ $3y$ and ₹ $4y$.

Given that A's profit = 1/5 of sales = $2x/5$

$$2x - 3y = \frac{1}{5}(2x)$$

$$\frac{4}{5}(2x) = 3y \Rightarrow y = \frac{8}{15}x$$

Profit of company B = $3x - 4y$

$$= 3x - 4 \times \frac{8}{15}x = \frac{13x}{15}$$

Hence the ratio of the profits of the two companies = $\frac{2}{5}x : \frac{13x}{15} = 6 : 13$

5. (C) According to the question, total number of toys is a perfect square number because the toys were packed in n boxes containing n toys each, without any remainder and among the options given only 1444 is a perfect square.

6. (B) Ratio of total capital of A and B = 20000 ×12 : 35000 × 12

= 240000 : 420000

Now C gives 220000 to both to make the capital equal.

A's capitial : B's capital

= 240000 : 420000

– 220000 : 220000

20000 : 200000

∴ Required ratio of divided amount = 1 : 10

7. (D) Let the number of minutes taken to empty the cistern be x min.

ATQ,

$$\frac{x}{6} - \frac{x+5}{12} - \frac{x+5}{15} = 0$$

$$\frac{x}{6} - \frac{x}{12} - \frac{x}{15} = \frac{5}{12} + \frac{5}{15}$$

$$\frac{x}{6} = \frac{45}{60}$$

x = 45 minutes

8. (B) Let extra hours per day are x.

By $\frac{M_1D_1H_1}{W_1} = \frac{M_2D_2H_2}{W_2}$

$$\frac{1 \times 1 \times (6+4)}{1} = \frac{1 \times 1 \times (6+6+x)}{1\frac{1}{2}}$$

$$\frac{3}{2} \times 10 = 12 + x$$

15 = 12 + x

x = 15 – 12 = 3

Extra hours of work per day is 3 hours

9. (D) ATQ,

Area of circular shell = Total surface area of cylinder

$\pi(12^2 - 8^2) = 2\pi\ R_1(R_1 + h)$

$80\pi = 2\pi\ (R_1^2 + R_1 h)$

$40 = R_1^2 + R_1 h$

$R_1 h = 40 - R_1^2$

$\therefore\ h = \frac{40 - R_1^2}{R_1}$

10. (D) $l\cos^2\theta + m\sin^2\theta = \frac{\cos^2\theta(\cos ec^2\theta + 1)}{\cos ec^2\theta - 1}$

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

$= 1 + \sin^2\theta = \cos^2\theta + \sin^2\theta + \sin^2\theta$

$= \cos^2\theta + 2\sin^2 (l-1)\cos^2\theta = (2-m)\sin^2\theta$

$\tan^2\theta = \frac{l-1}{2-m}$

$\therefore\ \tan\theta = \sqrt{\frac{l-1}{2-m}}$

11. (D) It is easy to solve this question by using option.

By option (D),

Total number of apples at the starting = 255

Number of apples sold to first customer = $\frac{255}{2} + \frac{1}{2}$ = 128

Remaining apples = 225 – 128 = 127

Number of apples sold to second customer = $\frac{127}{2} + \frac{1}{2}$ = 64

Remaining apples = 127 – 64 = 63

Number of apples sold to third customer = $\frac{63}{2} + \frac{1}{2}$ = 32

Remaining apples = 63 – 32 = 31

Number of apples sold to fourth customer = $\frac{31}{2} + \frac{1}{2}$ = 16

Remaining apples = 31 – 16 = 15, i.e. condition satisfied

12. (B) Let time spend on each Mathematics question = x min

ATQ,

Total time spent = $50x + 100 \times \frac{x}{2} + 50 \times \frac{x}{2} = 3 \times 160$

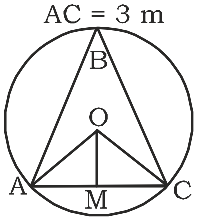
$x(50 + 50 + 25) = 180$

$x = \frac{180}{125}$

$\therefore$ Required time = $50 \times \frac{180}{125}$ = 72 minutes

13. (C) It is true that congruent triangles will be similar but opposite is not true. Also III will be true.

14. (C) AC = 3 m



Given OA = 3 cm

And $OM \perp AC$

Let $\angle AOM = \theta$

In ΔAOM,

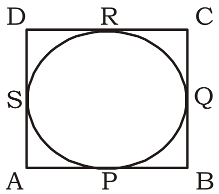
$$\sin\theta = \frac{AM}{OA}$$

$$\sin\theta = \frac{AC}{20A} = \frac{3}{2\times 3} = \frac{1}{2}$$

$$\sin\theta = \sin 30^\circ$$

$$\theta = 30^\circ$$

15. (C)



We know that tangents from an external point on the circumference of the circle will be equal.

AP = AS

BP = BQ

CR = CQ

DR = DS

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

AB + CD = AD + BC

16. (A) Let the sides are $5x$ and $12x$.

ATQ,

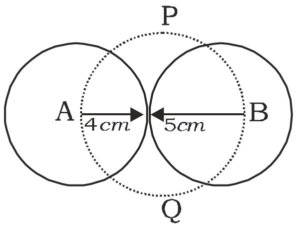
$$\frac{1}{2}\times 5x \times 12x = 270$$

$$x^2 = 9$$

$$x = 3$$

Hypotenuse = $13x$ = 13 × 3 = 39 cm

17. (A)

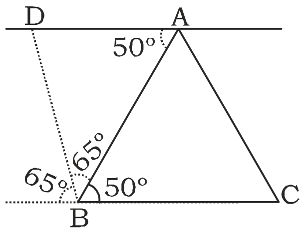


Radius of circle APBQ = $\frac{5+4}{2} = \frac{9}{2}$

Area of circle APBQ = $\pi R^2 = \pi \left[\frac{9}{2}\right]^2 = \frac{81\pi}{4}$ sq. cm.

18. (C) Area of square > Area of rectangle

19. (A)



$\angle ABC = 50^\circ$

$\angle DAB = \angle ABC$ [alternate angle]

$\angle DAB = 50^\circ$

In $\angle ADB$,

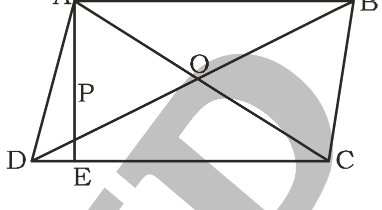
$\angle A + \angle D + \angle B = 180^\circ$

$50^\circ + \angle ADB + 65^\circ = 180^\circ$

$\angle ADB = 180^\circ - 115^\circ$

$\angle ADB = 65^\circ$

20. (A)



Area of the rhombus = $\frac{1}{2} \times d_1 \times d_2 = \frac{1}{2} \times 55 \times 48 = 1320$ cm^2

Area of the rhombus = base × height = DC × AE

So, DC × AE = 1320

$P \times \sqrt{\left(\frac{55}{2}\right)^2 + \left(\frac{48}{2}\right)^2} = 1320$

$P \times \sqrt{\frac{5329}{4}} = 1320$

$P = \frac{1320}{36.5} = 36.16$

So, 36 < P < 37 cm

21. (B) Let the radius of the circle be r and side of the square be a.

so, $2\pi r = 4a$ (Given)

$a = \frac{\pi r}{2}$

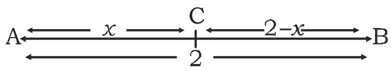
Area of the square = $\left(\frac{\pi r}{2}\right)^2 = 2.46r^2$ ......(i)

Area of the circle = $\pi r^2 = 3.14r^2$ ....(ii)

So, (ii) > (i) option (B) is correct

22. (B) Given

$AC^2 = AB \times CB$



$x^2 = 2\ (2-x)$

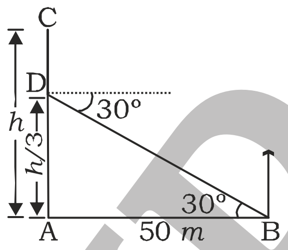
$x^2 + 2x - 4 = 0$

$x = \frac{-2 \pm \sqrt{4+16}}{2 \times 1} = -1 \pm \sqrt{5}$

BC = 2– ($-1 \pm \sqrt{5}$) = $3 - \sqrt{5}$ unit [Leaving $(3+\sqrt{5})$ because it is greater than 2]

23. (C) By the property of triangle

24. (D)



Let height of the pillar = h metres.

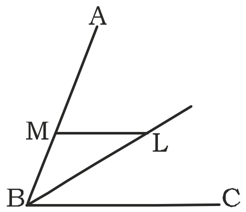
In ΔDAB,

$\tan 30° = \frac{\frac{h}{3}}{50}$

$\frac{1}{\sqrt{3}} = \frac{h}{3 \times 50}$

$h = 50\sqrt{3}$ metres

25. (C)



BL is bisector of $\angle ABC$

So, $\angle MBL = \angle LBC = x$ (let)

$ML \parallel BC$

$\angle LBC = \angle MLB = x$

$\angle MLB = \angle BML$

Can't be 90º, then triangle does not exist.

26. (A) Let the Length of candles be L.

The rate of burn of first candle = $\frac{L}{4}$ per hour

The rate of burn of second candle = $\frac{L}{3}$ per hour

Let after x hour the ratio be 2 : 1.

ATQ,

$$L - \frac{xL}{4} = 2\left(L - \frac{xL}{3}\right)$$

$$L\left(1 - \frac{x}{4}\right) = 2L\left(1 - \frac{x}{3}\right)$$

$$\frac{4-x}{4} = 2\left(\frac{3-x}{3}\right)$$

$x = 2\frac{2}{5}$ hours = 2 hours 24 min.

27. (A) Total Pipe = 6

1 outlet pipe takes = 6 hours

1 Inlet pipe takes = 9 hours

Tank is filled in only 9 hour which means the efficiency of one inlet pipe is utilized and rest became neutral which is possible only in one case

3 inlet pipes = 2 outlet pipes

$\therefore$ Total number of inlet pipe = 4

28. (D) Ratio of speed = 6 : 5

Speed of Train is 20% faster than the car.

Let, the time taken = t min

According to question,

6(t – 12.5) = 5t

$t = 6 \times \frac{12.5}{10} = 75$ min

$t = 1\frac{1}{4}$ hours

Speed of car $= \frac{75}{t} = \frac{75}{\frac{5}{4}}$

$S_c = 60$ km/hr

29. (A) 4A = 6B

$\frac{A}{B} = \frac{B}{C}$ $\quad \frac{B}{C} = \frac{11}{6}$

$$\left\{ \begin{array}{l} \frac{A}{B} = \frac{6}{4} \times \frac{11}{11} = \frac{66}{44} \\ \frac{B}{C} = \frac{11}{6} \times \frac{4}{4} = \frac{44}{24} \\ = A : B : C \\ = 66 : 44 : 24 \\ = 33 : 22 : 12 \end{array} \right.$$

30. (B) A $\rightarrow$ B 100% pure milk

B $\rightarrow$ 2 : 5

C $\rightarrow$ 3 : 8

B = 14 litre: 2 → 4 litre (M), 5 → 10 litre (W)

C = 22 litre: 2 → 6 litre (M), 5 → 16 litre (W)

Now, B + C = 36 litre = (14 + 22) litre

M: (4 + 6 litre) 10 litre

W: (10 litre + 16 litre) 26 litre

Now, to make M : W = 1 : 1

36 = 36 litre

10 litre (M) 26 litre (W) + 16 ltrs

+ 16 litre

26 litre : 26 litre = 52 litre

1 : 1

Thus, 16 litre of milk A is added.

31. (C) Let the population be x.

According to question,

100% of x + 15% of x = 45 million (Jan, 2006)

In Jan 2005 :

$x = \frac{45}{115} \times 100$ million = 39 million

32. (A)

500

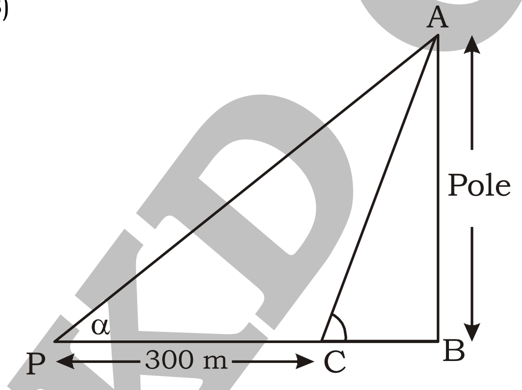
executive 50 → 48

general 450 → 377

Total booked seats 85% = 425

Vacant seats = 73

33. (B)



$\because \quad \tan\alpha = \frac{5}{12}$

$\frac{AB}{BP} = \frac{5}{12}$

$\frac{AB}{BC+300} = \frac{5}{12}$ ....(i)

$\tan B = \frac{3}{4}$

$\frac{AB}{BC} = \frac{3}{4}$ ....(ii)

On dividing (i) by (ii), We have

$\frac{BC}{BC+300} = \frac{5}{12} \times \frac{4}{3} = \frac{5}{9}$

9BC = 5BC + 1500

$BC = \frac{1500}{4} = 375m$

Height of the pole = AB = $\frac{3}{4} \times BC = \frac{3}{4} \times 375$

$= \frac{1125}{4} = 281.25$ m

34. (A) $(\sin A + \operatorname{cosec} A)^2 + (\cos A + \sec A)^2$

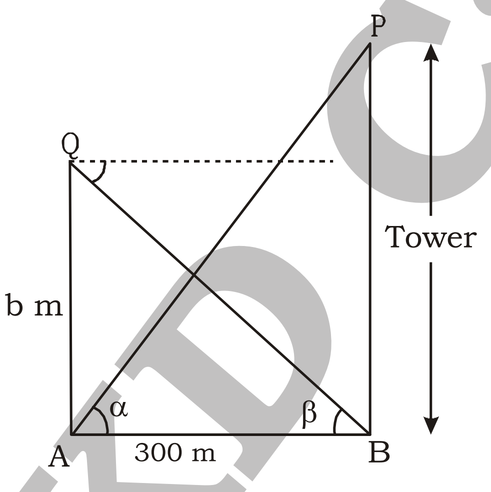
$= \sin^2 A + \operatorname{cosec}^2 A + 2\sin A.\operatorname{cosec} A + \cos^2 A + \sec^2 A + 2\cos A.\sec A$

$= \sin^2 A + \cos^2 A + \operatorname{cosec}^2 A + \sec^2 A + 2.1 + 2.1$

$= 1 + 1 + \cot^2 A + 1 + \tan^2 A + 4$

$= 7 + \cot^2 A + \tan^2 A$

35. (D)



In ΔABQ,

$\tan\beta = \frac{QA}{AB}$

$\tan\beta = \frac{b}{AB}$

$AB = \frac{b}{\tan\beta}$

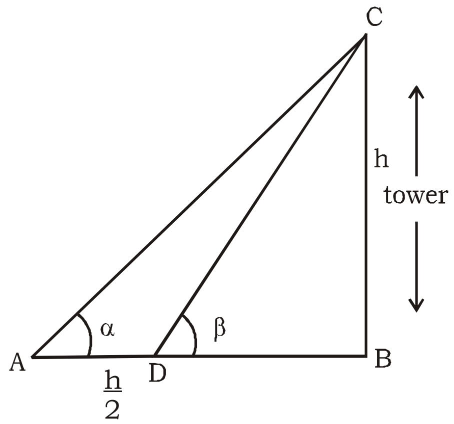
In ΔABP,

$$\tan\alpha = \frac{PB}{AB}$$

$$\tan\alpha = \frac{PB}{\frac{b}{\tan\beta}}$$

PQ = $\tan\alpha.\frac{b}{\tan\beta}$ = $b\tan\alpha\cot\beta$

36. (C)



In ΔCBD,

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

BD = $\frac{h}{\tan\beta} - h\cot\beta$

In ΔCBA,

$$\tan\alpha = \frac{CB}{BA} = \frac{CB}{BD + DA}$$

$$\tan\alpha = \frac{h}{h\cot\beta + \frac{h}{2}}$$ ($\because$ BD = hcotβ)

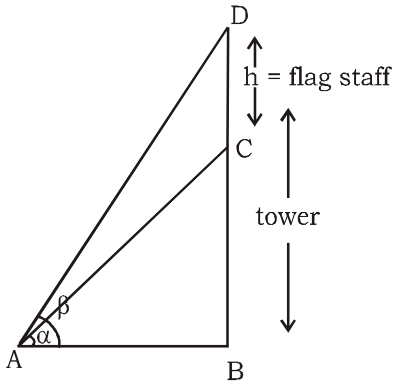
$$\tan\alpha = \frac{h}{h\left(\cot\beta + \frac{h}{2}\right)}$$

$$\cot\beta + \frac{1}{2} = \frac{1}{\tan\alpha}$$

$$\cot\beta + \frac{1}{2} = \cot\alpha$$

$$\cot\alpha - \cot\beta = \frac{1}{2}$$

37. (B)



Let the height of the tower be x unit

In ΔCBA,

$$\tan\alpha = \frac{CB}{BA} = \frac{x}{BA}$$

$$BA = \frac{x}{\tan\alpha} = x\cot\alpha \qquad \text{.............. (i)}$$

In ΔDBA,

$$\tan\beta = \frac{DB}{BA} = \frac{h+x}{x\cot\alpha} \qquad (\because \text{ BA} = x\cot\alpha)$$

$$x\cot\alpha = \frac{h+x}{\tan\beta} = (h+x)\cot\beta$$

$$x(\cot\alpha - \cot\beta) = h\cot\beta$$

$$x = \frac{h\cot\beta}{\cot\alpha - \cot\beta}$$

$$x = \frac{\frac{h}{\tan\beta}}{\frac{1}{\tan\alpha} - \frac{1}{\tan\beta}}$$

$$x = \frac{h}{\tan\beta} \times \frac{\tan\alpha\tan\beta}{\tan\beta - \tan\alpha} = \frac{h\tan\alpha}{\tan\beta - \tan\alpha}$$

38. (B) $2(\sin^6 q + \cos^6 q) - 3(\sin^4 q + \cos^4 q) + 1$

$$= 2\left[\left(\sin^2 q\right)^3 + \left(\cos^2 q\right)^3\right] - 3\left[\left(\sin^2 q\right)^2 + \left(\cos^4 q\right)^2\right] + 1$$

$$= 2\left[\left(\sin^2 q + \cos^2 q\right)^3 - 3\sin^2 q\cos^2 q(\sin^2 q + \cos^2 q)\right]$$

$$-3\left[\left(\sin^2 q + \cos^2 q\right)^2 - 2\sin^2 q.\cos^2 q\right] + 1$$

$$= 2\left[1^3 - 3\sin^2 q.\cos^2 q.(1)\right] - 3\,[(1)^2 - \sin^2 q.\cos^2 q] + 1$$

$$= 2 - 6\sin^2 q\cos^2 q - 3 + 6\sin^2 q\cos^2 q + 1$$

$$= 2 - 3 + 1 = 0$$

39. (C) $\sin\theta + \sin^2\theta + \sin^3\theta = 1$

$\sin\theta + \sin^3\theta = 1 - \sin^2\theta$

On squaring both sides,

$[(\sin\theta)(1+\sin^2\theta)]^2 = \cos^4\theta$

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

$(1-\cos^2\theta)[4-4\cos^2\theta+\cos^4\theta] = \cos^4\theta$

$4-4\cos^2\theta+\cos^4\theta-4\cos^2\theta+4\cos^4\theta - \cos^6\theta = \cos^4\theta$

$-\cos^6\theta+4\cos^4\theta-8\cos^2\theta+4=0$

$\cos^6\theta-4\cos^4\theta+8\cos^2\theta=4$

40. (C) $a=(\sqrt{3}+\sqrt{2})^{-3},\ b=(\sqrt{3}-\sqrt{2})^{-3}$

ab = $\left[(\sqrt{3}+\sqrt{2})(\sqrt{3}-\sqrt{2})\right]^{-3}$

$=\left[3-2\right]^{-3} = (1)^{-3} = 1$

= $(a+1)^{-1}+(b+1)^{-1}$ = $\frac{1}{a+1}+\frac{1}{b+1}$

$=\frac{b+1+a+1}{ab+b+a+1} = \ = \frac{a+b+2}{1+a+b+1}$

$=\frac{a+b+2}{a+b+2}$ = 1

41. (A) Let 1 child's 1 day's work =x and 1 adult's 1 day's work = y

Then,

$12x=\frac{1}{16}$

$x=\frac{1}{192}$

$8y=\frac{1}{12}$

$y=\frac{1}{96}$

Work done in 3 days by 16 adults $=16\times\frac{1}{96}\times 3=\frac{1}{2}$ part

Remaining work $=\frac{1}{2}$ part

Now, (6 adults + 4 children)'s 1 day's work $=\frac{6}{96}+\frac{4}{192}=\frac{1}{12}$

i.e. $\frac{1}{12}$ work is done by them is 1 day

So, $\frac{1}{2}$ work will be done by them in = $12\times\frac{1}{2}$ days = 6 days

42. (C) Time taken by A to complete the work $= \frac{4\times3}{2}$ = 6 days

Time taken by B to complete the work = $\frac{6\times5}{3} = 10$ days

$\therefore$ A and B together will complete the work in $\frac{6\times10}{6+10}$ days $= 3\frac{3}{4}$ days

43. (C) Completed road in 80 days by 280 workers = $\frac{7}{2}$ km = 3.5 km

Remaining road to be completed in 20 days = 1.5 km

Let, total x workers are needed to construct the 1.5 km road in 20 days.

So, $\frac{280\times80}{x\times20} = \frac{3.5}{1.5}$

$x = 280\times\frac{80}{20}\times\frac{1.5}{3.5}$

x = 480 workers

Number of more workers needed = (480 – 280) = 200 workers

44. (C) For the first trader,

Let the CP of the article = ₹ 100

SP = ₹ 120

Now, For the second trader,

SP of the article = ₹ 120

Gain = 20%

Let the CP be ₹ x.

$\frac{120-x}{120}\times100 = 20$

$120 - x = 20\times\frac{6}{5} = 24$

$x = 120 - 24$ = ₹96

Gain = ₹ 24

Now when difference of gains = ₹ 4, then SP = ₹ 120

So, When the difference = ₹ 85, then SP = $\frac{120}{4}\times85$ = ₹ 2550

45. (A) By Alligation method

$\frac{3}{5}$ $\quad$ $\frac{4}{9}$

$\frac{1}{2}$

$\frac{1}{2}-\frac{4}{9}=\frac{1}{18}$ $\quad$ $\frac{3}{5}-\frac{1}{2}=\frac{1}{10}$

Required ratio of mixture = $\frac{1}{18}:\frac{1}{10}$ = 10 : 18 = 5 : 9

ATQ,

Amount of the former mixture = 3 litre

So, required of the later mixture = $3\times\frac{9}{5}$ litre = $5\frac{2}{5}$ litre

46. (C) ATQ,

$\frac{2}{5}A+40=\frac{2}{7}B+20=\frac{9}{17}C+10=x$ (let)

$A=\frac{5}{2}(x-40)$, $B=\frac{7}{2}(x-20)$ and $C=\frac{17}{9}(x-10)$

$\frac{5}{2}(x-40)+\frac{7}{2}(x-20)+\frac{17}{9}(x-10)$ = 600

x = 100

A's share = ₹$\frac{5}{2}(100-40)$ = ₹ 150

47. (A) Let x be the initial no. of people in the company.

ATQ,

$\frac{35x+5\times32}{x+5}=34$

$35x + 160 = 34x + 170$

$x = 10$

48. (D) Initial bowling average = 12.4

After improving bowling average by 0.2.

New bowling average = 12.4 – 0.2 = 12.2

Now, let x be the number of wickets taken before the last match.

ATQ,

$\frac{12.4x+26}{x+4}=12.2$

$12.4x + 26 = 12.2x + 48.8$

$0.2x = 22.8$

$x=\frac{22.8}{0.2}=114$

Number of wickets taken before the last match = 114

49. (A) Average speed during the entire journey = $\frac{\text{Total distance}}{\text{Total time}}$

$= \frac{3584\,\text{km}}{2\,\text{days}\,8\,\text{hours}} = \frac{3584\,\text{km}}{56\,\text{hours}}$ = 64 km/hour

Now, Average speed during the remaining part (last 8 hr.) of journey

$= \frac{3584-(1440+1608)}{8}$ km/hr.

$= \frac{3584-3048}{8} = \frac{536}{8}$ = 67 km/hr

So, required difference = (67 – 64) km/hr = 3 km/hr

50. (B) Weight of lead per kg in the new alloy $= \frac{3}{(5+4+2)\times 2} = \frac{3}{24} = \frac{1}{8}$ kg

51. (A) In 2010, profit of Company M = 4.5 crore

Profit of Company (P + N) = (4 + 3) = 7 crore

∴ Required% = $\frac{4.5}{7}$ × 100 = 64.28%

52. (D) Expenditure of Company M in the year 2011 is 75 crore.

Profit of Company M in year 2011 is 4 crore.

Income of Company M in year 2011 is 75 + 4 = 79 crore

Now, expenditure of Company P in the year 2011 is 68 crore.

Profit of Company P in the year 2011 is 7 crore.

Income of Company P in the year 2011 is (68 + 7) = 75 crore

∴ Required ratio = 79 : 75

53. (B) In the year 2012 profit of Company M = 6 crore

Expenditure = 6 $\left(1+\frac{50}{100}\right)$ = 9 crore

Income = (9 + 6) = 15 crore

Profit of Company N in the year 2012 = 6.5 crores

Expenditure = 6.5 $\left(1+\frac{60}{100}\right)$ = 6.5 × $\frac{8}{5}$ = 1.3 × 8 = 10.4 crore

Hence, Income = (6.5 + 10.4) = 16.9 crore

Again, Profit of Company P in the year 2012 = 5 crore

Expenditure = 5 $\left(1+\frac{80}{100}\right)$ = 5 × $\frac{9}{8}$ = 9 crore

Hence, Income = (9 + 5) = 14 crore

Now, average income of all three companies = $\frac{1}{3}$ (15 + 16.9 + 14) = $\frac{45.9}{3}$ = 15.3 crore

54. (C) Profit of Company N in the year 2009 = 2 crore
Profit of Company N in the year 2012 = 6.5 crore
Increase = (6.5 – 2) = 4.5 crore

Increase% = $\frac{4.5}{2} \times 100 = 225\%$

55. (D) Income of Company P in the year 2010 = 40 crore

Income of Company M in the year 2010 = $40\left(1+\frac{20}{100}\right)$ = 48 crore

Now, profit of Company M in the year 2010 = 4.5 crore

∴ Expenditure of Company M in the year 2010 = (48 – 4.5) crore = 43.5 crore

56. (C) Let x = number of benches
ATQ,
$6(x + 1) = 7x - 5$
$7x - 6x = 6 + 5$
$x = 11$
Number of students = $6(x + 1) = 72$

57. (C) Let the number of workers be x.
ATQ,
$x \times 8500 = 7 \times 10000 + (x - 7)\ 7800$
$85x = 700 + 78(x - 7)$
$85x - 78x = 700 - 546$
$7x = 154$
$x = \frac{154}{7} = 22$

58. (B) Let the average expenditure per students = ₹ x
Original total expenses = ₹ $35x$
Now total expenses = ₹$(35x + 42)$
New average expenditure per student = ₹$(x - 1)$

$\frac{35x+42}{35+7} = \frac{35x+42}{42} = (x-1)$

$35x + 42 = 42x - 42$
$x = 12$
The original expenditure = 35×12 = ₹ 420

59. (B) Let the amount invested by P and Q are ₹ $5x$ and ₹ $6x$ respectively
Ratio of investment of P, Q and R = $5x \times 12 : 6x \times 12 : 6x \times 6 = 5 : 6 : 3$
Total profit = ₹ 98000 = 20% of total investment

Total investment = ₹$\frac{98000 \times 100}{20}$ = ₹ 490000

So, R's investment = $\frac{3}{14} \times 490000$ = ₹ 105000

60. (B) Let 't' be time taken to arise the water level by 7cm.

Now, radius of pipe = $\frac{14}{2}$ cm = 7 cm

So, Water flow by pipe = volume of tank

$$\pi \times \frac{7}{100} \times \frac{7}{100} \times 5 \times \frac{5}{18} \times t = 50 \times 44 \times \frac{7}{100}$$

$$t = \frac{100 \times 18 \times 50 \times 44 \times 7 \times 7}{22 \times 7 \times 7 \times 25}$$

t = 7200 seconds

$$t = \frac{7200}{60 \times 60} = 2 \text{ hours}$$

61. (D) Let L and S = length and speed of the train

So, L = (S – 6) kmph × 5 sec ....(i)

L = (S – 7.5) kmph × 5.5 sec ....(ii)

From (i) and (ii),

(S – 6)kmph × 5 sec = (S – 7.5) kmph × 5.5 sec

5S – 30 = 5.5S – 41.25

S = 22.5 kmph

L = 22.92 m

62. (A) $\frac{P\sin\theta - q\cos\theta}{P\sin\theta + q\cos\theta} = \frac{P\tan\theta - q}{P\tan\theta + q}$

$$= \frac{P\frac{P}{q} - q}{P\frac{P}{q} + q} = \frac{P^2 - q^2}{p^2 + q^2}$$

63. (B) $\sin\theta = \frac{3}{4}$

Then, $\sqrt{\frac{\operatorname{cos}ec^2\theta - \cot^2\theta}{\sec^2\theta - 1}}$

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

$$= \sqrt{\frac{\sin^2\theta}{\sin^2\theta} \times \frac{\cos^2\theta}{\sin^2\theta}} = \sqrt{\frac{\cos^2\theta}{\sin^2\theta}}$$

$$= \sqrt{\frac{1-\sin^2\theta}{\sin^2\theta}} = \sqrt{\frac{1-\frac{9}{16}}{\left(\frac{3}{4}\right)^2}}$$

$$= \frac{\sqrt{7}}{4} \times \frac{4}{3} = \frac{\sqrt{7}}{3}$$

64. (A) $\sin^4\theta - \cos^4\theta$

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

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

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

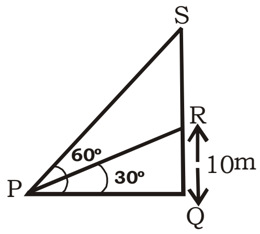
Hence (A) is not a correct statement.

65. (D) Let RQ be the height of building, i.e., RQ = 10cm, S be the position of helicopter.

In $\triangle PQR$,

$\frac{RQ}{PQ} = \tan 30^\circ$

$PQ = \frac{RQ}{\tan 30^\circ} = 10\sqrt{3}$ m



In $\triangle SPQ$,

$\tan 60^\circ = \frac{SQ}{PQ}$

$\frac{SQ}{PQ} = \sqrt{3}$

$SQ = PQ \times \sqrt{3} = 10\sqrt{3} \times \sqrt{3} = 30$ m

66. (C) As BC $\parallel$ AD and the diagonals of a trapezium divide each other proportionally.

So, $\frac{AO}{OC} = \frac{BO}{OD}$

$\frac{3x-1}{5x-3} = \frac{2x+1}{6x-5}$

$(3x-1)(6x-1)$

$(5x-3)(2x+1)$

$18x^2 - 15 - 6x + 5$

$10x^2 + 5x - 6x - 3$

$8x^2 - 20x + 8 = 0$

$4x^2 - 10x + 4 = 0$

$4x^2 - 8x - 2x + 4 = 0$

$4x(x-2) - 2(x-2) = 0$

$(4x-2)(x-2) = 0$

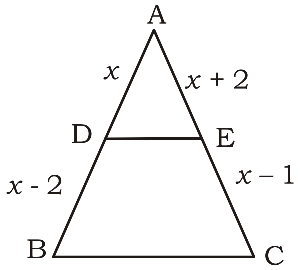
$x = \frac{1}{2}$ or $x = 2$

But as $x = \frac{1}{2}$ will make OC negative.

$\therefore$ $x = 2$

67. (D) As DE $\parallel$ BC, so by basic proportionality theorem.

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



$$\frac{x}{x-2} = \frac{x+2}{x-1}$$

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

$x^2 - x = x^2 - 4$

$x = 4$

68. (D) Let length of rectangle = x and breadth of rectangle = y

$(x+2)(y-2) = xy + 20$

$xy + 2y - 2x - 4 = xy + 20$

$2y - 2x = 24$

$y - x = 12$ ....(i)

Also, $(x-2)(y-1) = xy - 37$

$xy - x - 2y + 2 = xy - 37$

$2y + x = 39$ ....(ii)

On solving equations (i) and (ii), we get

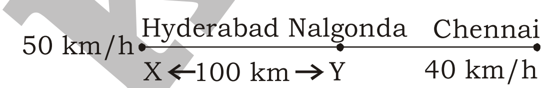
$x = 5$ and $y = 17$

Hence, area of rectangle = xy

= 5 × 17 = 85 sq.m

69. (A) Distance travelled by Hyderabad Express in 1 h = 50 km

Distance travelled by Nalgonda Express in $\frac{1}{2}$ h = 20 km



At 6 : 30, distance between 2 trains = 30 km

Time taken to travel this 30 km = $\frac{30}{50+40} = \frac{1}{3}$ h

$= \frac{1}{3} \times 60 = 20$ min

70. (D) Suppose D got x marks.

Marks obtained by C = 80% of $x = \frac{4x}{5}$

Marks obtained by B = 125% of $\frac{4x}{5} = \frac{125}{100} \times \frac{4x}{5} = x$

Marks obtained by A = 90% of $x = \frac{9x}{10}$

ATQ,

$\frac{9x}{10} = 360$

$x = 400$

Percentage of marks obtained by D = $\frac{400}{500} \times 100 = 80\%$

71. (B) Present worth of money for Anu,

$1120 - P = \frac{P \times 6 \times 2}{100}$

P = ₹ 1000

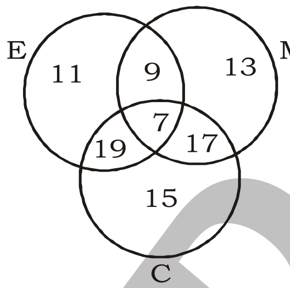
Present worth of money for Biresh $1081.50 - \frac{P \times 6 \times 1}{100}$

$108150 - 100P = 3P$

P = ₹ 1050

∴ Biresh should pay ₹ 50.

72. (C) The Venn diagram represents the no. of students who passed in the respective subjects.
Number of students who passed in one or more subjects = 11 + 9 + 13 + 17 + 15 + 19 + 7 = 91



Number of students who failed in all the subjects = 100 – 91= 9

73. (B) $y - 5 = -(\sqrt[3]{25} + \sqrt[3]{5})$

$= -5^{\frac{2}{3}} - 5^{\frac{1}{3}} = -\left(5^{\frac{2}{3}} + 5^{\frac{1}{3}}\right)$

$(y - 5)^3 = -5^2 - 5 - 3 \cdot 5^{\frac{2}{3}}.5^{\frac{1}{3}}\left(5^{\frac{2}{3}} + 5^{\frac{1}{3}}\right)$

$(x - 5)^3 = -25 - 5 + 15(y - 5)$

$y^3 - 15y^2 + 75y - 125 = -30 + 15y - 75$

$y^3 - 15y^2 + 60y + 40 = 60$

74. (D) we have,

$a\sec\theta + b\tan\theta + c = 0$

and $p\sec\theta + q\tan\theta + r = 0$

Solving these two equations for $\sec\theta$ and $\tan\theta$ by the cross multiplication, we get

$$\frac{\sec\theta}{br-qc} = \frac{\tan\theta}{cp-ar} = \frac{1}{aq-bp}$$

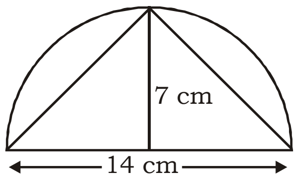
$$\sec\theta = \frac{br-cq}{aq-bp} \text{ and } \tan\theta = \frac{cp-ar}{aq-bp}$$

Now, $\sec^2\theta - \tan^2\theta = 1$

$$\left(\frac{br-cq}{aq-bp}\right)^2 - \left(\frac{cp-ar}{aq-bp}\right)^2 = 1$$

$(br - cq)^2 - (cp - ar)^2 = (aq - bp)^2$

75. (D)



Given that,

radius = 7 cm

diameter = 14 cm

Area of the triangle = 7^2 = 49 sq. cm.

Area of semi-circle = $\frac{\pi r^2}{2} = \frac{\frac{22}{7}\times 7^2}{2}$

= 11 × 7 = 77 sq. cm.

∴ Required answer = Area of semi-circle – Area of the largest triangle = (77 – 49) = 28 sq. cm.

76. (A) Total number of students qualified in the examination from colleges R and S

= (3250 + 1500) = 4750

Average number of students qualified in the examination from colleges R and S

$= \frac{4750}{2} = 2375$

Total number of students appeared in the examination from colleges R and S

= (3750 + 2500) = 6250

Average number of students appeared in the examination from colleges R and S

$= \frac{6250}{2} = 3125$

∴ Required percentage = $\left(\frac{2375\times 100}{3125}\right)$ = 76%

77. (C) Total number of students appeared in the scholarship exam from R and T

= (3750 + 3000) = 6750

Total number of students qualified in the scholarship exam from R and T

= (3250 + 2250) = 5500

$\therefore$ Required ratio = $\frac{6750}{5500}$ = 27 : 22

78. (D) Required ratio = $\frac{2250}{1500}$ = 3 : 2

79. (C) Total number of students appeared for the scholarship exam from college S = 2500

Total number of students appeared for the exam from all the colleges

= (3500 + 2750 + 3750 + 2500 + 3000) = 15500

$\therefore$ Required percentage = $\frac{2500 \times 100}{15500}$ = 16.12%

80. (A) Total number of students appeared for the exam from all the colleges

= (3500 + 2750 + 3750 + 2500 + 3000) = 15500

Average = $\frac{15500}{5}$ = 3100

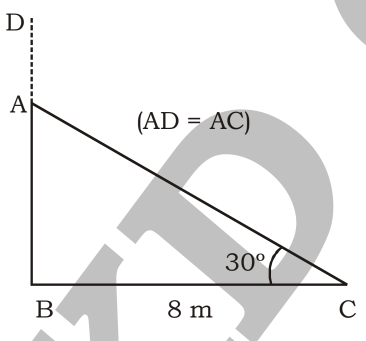
Total number of students qualified for the exam from all the colleges

= (2250 + 1500 + 3250 + 1500 + 2250) = 10750

Average = $\frac{10750}{5}$ = 2150

$\therefore$ Required difference = (3100 – 2150) = 950

81. (B)



In ΔABC,

tan 30° = $\frac{AB}{BC}$

$\frac{1}{\sqrt{3}} = \frac{AB}{8}$

AB = $\frac{8}{\sqrt{3}}$ m

Again,

$\cos 30^\circ = \frac{BC}{AC}$

$\frac{\sqrt{3}}{2} = \frac{8}{AC}$

$AC = \frac{16}{\sqrt{3}}$

DB = AB + AD = AB + AC (∵ AD = AC)

$= \frac{8}{\sqrt{3}} + \frac{16}{\sqrt{3}} = \frac{24}{\sqrt{3}} = 8\sqrt{3}$ m

82. (B) Let the tank get empty in m h after 8 am.

Now, work done [by L in m h + by M in $(m-1)$ + by N in $(m-3)$h] = 0

$\frac{m}{15} + \frac{m-1}{12} - \frac{m-3}{4} = 0$

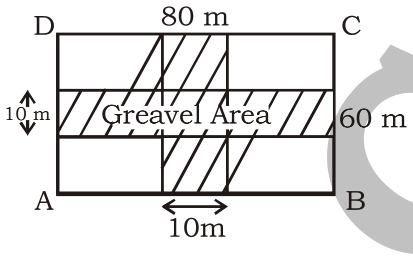
$4m + 5(m-1) - 15(m-3) = 8$

$6m = 40$

$m = \frac{20}{3}$ h = 6 h 40 min

∴ Tank will be emptied 6 h 40 min after 8 am i.e., at 2 : 40 pm.

83. (A)



Let ABCD be a rectangular grass plot whose length = l = 80 m and breadth = b = 60 m

Two roads of width W = 10 m (shaded part) are crossing each other at the middle of plot.

Area of roads = $W(l + b - W)$ = 10(80 + 60 – 10)m² = 1300 m²

Cost of gravelling the roads = rate of gravelling / m² × area of roads

= 2 × 1300 = ₹ 2600

84. (C) Let r = radius of hemisphere bowl.

$2\pi r = 176$

r = 28 cm

Volume of the quantity in hemispherical punch bowl = $\frac{1}{2} \times \frac{2}{3}\pi^3 = \frac{1}{3}\pi \times 28^3$ cm³

Volume of the bowl in which food is to be served = $\frac{2}{3}\pi \times 2^3$ cm³.

Number of persons served = $\frac{\frac{1}{3}\pi \times 28^3}{\frac{2}{3}\pi \times 2^3} = 1372$

85. (B) Given roots are real and equal.

$B^2 - 4AC = 0$

$[-2(a^2 - bc)]^2 - 4(c^2 - ab)(b^2 - ac) = 0$

$4(a^4 + b^2c^2 - 2a^2bc - c^2b^2 + ac^3 + ab^3 - a^2bc = 0$

$4a(a^3 + b^3 + c^3 - 3abc) = 0$

$a^3 + b^3 + c^3 = 3abc$

86. (B) Required punctuality = $\frac{1250+1400}{1400+1490}\times 100\%$

$= \frac{2650}{2890}\times 100\% = 91.7\%$

87. (C)

$$\begin{array}{l} x - y = w + z + 6 \\ \underline{x + y = w - z - 3} \\ \quad 2x = 2w + 3 \end{array}$$

$2x - 2w = 3$

$x - w = \frac{3}{2} = 1.5$

88. (C) $(\sqrt[3]{3.5}+\sqrt[3]{2.5})\{(\sqrt[3]{3.5})^2 - \sqrt[3]{8.75} + (\sqrt[3]{2.5})^2\}$

$= (\sqrt[3]{3.5})^3 + (\sqrt[3]{2.5})^3$ [by using $(a + b)(a^2 - ab + b^2) = a^3 + b^3$]

$= 3.5 + 2.5 = 6$

89. (C)

	₹ **500**	**Required Sum**
Rate of Interest	12%	10%
S.I. after 4 years	480	480

S.I. is same

$\frac{₹\ 500}{\text{Required Sum}} = \frac{10\%}{12\%}$

$\frac{₹\ 500}{\text{Required Sum}} = \frac{5}{6}$

Required sum = ₹ $\frac{500}{5}\times 6$ = ₹ 600

90. (B) Radius of the shot put ball = 7 cm

Height of the cylinder = $\frac{7}{3}$ cm

Volume of the shot put = Volume of the cylinder

$\frac{4}{3}\pi\times 7^3 = \pi\times R^2\times\frac{7}{3}$

$R^2 = \frac{\frac{4}{3}\pi\times 7^3\times\frac{3}{7}}{\pi}$

$R = \sqrt{4\times 7^2} = 2 \times 7 = 14$ cm

$d = 2R = 2 \times 14 = 28$ cm

91. (B) Let x hour = time taken by pipe A alone to empty the pool
$2x$ hour = time taken by pipe B alone to empty the pool

So, Time taken by pipe A & B together to empty the pool = $\frac{x \times 2x}{x + 2x}$ hours

= $\frac{2x^2}{3x}$ hours = $\frac{2}{3}x$ hours

Time taken by pipe C alone to empty the pool = $\left(\frac{2}{3}x \times 2\right)$ = $\frac{4}{3}x$ hours

Part of the pool which will be empty when A, B & C work together = $\left(\frac{1}{x} + \frac{1}{2x} + \frac{3}{4x}\right)$ part

= $\left(\frac{4+2+3}{4x}\right)$ part = $\frac{9}{4x}$ part

Total time taken by A, B & C working together to empty the pool = $\frac{4x}{9}$

= 400 minutes [6 hour 40 minutes = 400 min]

x = $\frac{400 \times 9}{4}$ = 900 minutes = 15 hours

92. (B) Volume of water due to 2 cm rain on a square km land = 1km × 1 km × 2 cm

= $1000\text{m} + 1000\text{m} \times \frac{2}{100}\text{m}$ = 20000 m^3

50% of volume of rain drops = 10000m^3

Now, Required level by which the water level in the pool will be increased

= $\frac{10000}{100 \times 10}$ = 10 m

93. (D) Let the number be x and y.

1st number × 2nd number

H. C. F × L. C. M

$3x \times 4x = 2028$

$x^2 = \frac{2028}{3 \times 4}$ = 169

$x^2 = \sqrt{169}$

x = 13

∴ Sum of numbers = $3x + 4x = 7x$

= 7 × 13 = 91

94. (D) $5^{x+3} = 625 = 5^4$

$x + 3 = 4$

$x + 3 = 4$

$x + 4 - 3 = 1$

∴ $8^{x+2} = 8^3 = 512$

95. (B) $21\frac{51}{169} = \frac{21\times169+51}{169} = \frac{3600}{169}$

$\therefore \sqrt{21\frac{51}{169}} = \sqrt{\frac{3600}{169}}$

$= \frac{60}{13} = 4\frac{8}{13}$

96. (A) Required expenditure = $\frac{72}{360}\times 90{,}000$ = ₹ 18000

97. (A) Cement + steel + supervision = 72° + 54° +54° = 180°

Percent of total cost = $\frac{180}{360}\times 100$ = 50%

98. (A) Required percentage = $\frac{72-54}{72}\times 100$ = 25%

99. (B) Required exceed = 90 – 54 = 36°

Required amount = $\frac{36}{360}\times 90{,}000$ = ₹ 9000

100. (C) Cement + Steel + Timber = 72 + 54 + 36 = 162

Labour + Timber = 90 + 36 = 126

Required% = $\frac{36}{126}\times 100$ = 28.57%

QUANTITATIVE ABILITY - 78 (ANSWER KEY)

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