SSC CGL Tier-II Exam. Practice Set

Answers with Explanation

1. (c) $\frac{2851}{23}\times\frac{2862}{23}\times\frac{2862}{23}\times\frac{2873}{23}\times\frac{2873}{23}\times\frac{2873}{23}$

$=\frac{22\times10\times10\times21\times21\times21}{23}=\frac{462\times100\times441}{23}$

$=\frac{2\times8\times4}{23}=\frac{64}{23}$

Remainder $\rightarrow 18$

2. (b) HCF = Common factors in a, b, c and d
$= 2^{125}\times3^{81}\times5^{128}$

3. (c) Greatest number of 4-digits is 9999.
L.C.M. of 15, 25, 40 and 75 is 600.
On dividing 9999 by 600, the remainder is 399.
∴ Required number = (9999 – 399) = 9600.

4. (b) Let the unit digit = x
Ten digit = x – 2
∴ Number = 10(x – 2) + x
= 11x – 20
→ New number obtained after reversing the digits
= 10x + x – 2 = 11x – 2
ATQ,

$3(11x-20)+\frac{6}{7}(11x-2)=108$

$\Rightarrow 7(11x-20)+2(11x-2)=36\times7$

$\Rightarrow 77x-140+22x-4=252$

$\Rightarrow 99x=252+144$

$\Rightarrow x=\frac{396}{99}=4$

∴ Number = 11x – 20
= 11 × 4 – 20 = 24
∴ Sum of digit = 2 + 4 = 6

5. (b) $2^{\frac{1}{2}}\times2^{\frac{2}{4}}\times2^{\frac{3}{8}}\times2^{\frac{4}{16}}\times\ldots$

$=2^{\frac{1}{2}+\frac{2}{4}+\frac{3}{8}+\frac{4}{16}+\frac{5}{32}+\ldots}=2^x$

$\Rightarrow x=\frac{1}{2}+\frac{2}{4}+\frac{3}{8}+\frac{4}{16}$ ...(i)

$\Rightarrow \frac{x}{2}=\frac{1}{4}+\frac{2}{8}+\frac{3}{16}+\frac{4}{32}$ ...(ii)

(i) – (ii)

$\frac{x}{2}=\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}+\ldots$

$\frac{x}{2}=\frac{1/2}{1-1/2}=1\Rightarrow x=2$

$\therefore 2^x=2^2=4$

6. (d) $=\frac{1}{abc}*\frac{(s-a)^2+(s-b)^2+(s-c)^2+s^2}{a^2+b^2+c^2}$

$=\frac{1}{abc}*\frac{s^2-2sa+a^2+s^2+b^2-2sb+s^2-2sc+c^2+s^2}{a^2+b^2+c^2}$

$=\frac{1}{abc}*\frac{4s^2+a^2+b^2+c^2-2s(a+b+c)}{a^2+b^2+c^2}$

$=\frac{1}{abc}*\frac{4s^2+a^2+b^2+c^2-4s^2}{a^2+b^2+c^2}=\frac{1}{abc}$

7. (b) $a+b=\frac{\left(\sqrt{5}+1\right)^2+\left(\sqrt{5}-1\right)^2}{5-1}=\frac{2\left[\left(\sqrt{5}\right)^2+1\right]}{4}$

a + b = 3
a.b = 1

$\left(\frac{a^2+ab+b^2}{a^2-ab+b^2}\right)\times3=\left(\frac{(a+b)^2-ab}{(a+b^2)-3ab}\right)\times3$

$=\left(\frac{3^2-1}{3^2-3}\right)\times3=\frac{4}{3}\times3=4$

8. (b) $\Rightarrow\frac{1}{4}+\frac{1}{3}+\frac{3}{8}+\frac{2}{5}+\ldots\frac{19}{20}$

$\Rightarrow\frac{1}{4}+\frac{2}{6}+\frac{3}{8}+\frac{4}{10}+\ldots\frac{19}{20}$

$=\frac{1}{2}\left[\frac{1}{2}+\frac{2}{3}+\frac{3}{4}+\frac{4}{5}+\ldots\frac{19}{20}\right]$

$=\frac{1}{2}\left[-1+\frac{1}{2}-1+\frac{2}{3}-1+\frac{3}{4}-1+\frac{4}{5}-1+\ldots\frac{19}{20}-1+20\right]$

$=\frac{1}{2}\left[-1-\frac{1}{2}-\frac{1}{3}-\frac{1}{4}-\frac{1}{5}\ldots-\frac{1}{20}+20\right]$

$=\frac{1}{2}\left[20-K\right]=10-\frac{K}{2}$

9. (b) $a^2+\frac{1}{4a^2}-1=9$

$a^2+\frac{1}{4a^2}=10$ ...(i)

$\left(a+\frac{1}{2a}\right)^2=a^2+\frac{1}{4a^2}+1=11$

$$a+\frac{1}{2a}=\sqrt{11}$$

$$a^2-\frac{1}{4a^2}=3\sqrt{11} \qquad ...(ii)$$

$$\left(a^2+\frac{1}{4a^2}\right)\left(a^2-\frac{1}{4a^2}\right)=30\sqrt{11}$$

10. (b) $x+\sqrt{x^2+\sqrt{x^4+\sqrt{x^8+\sqrt{x^{16}+...}}}}$

$$x+\sqrt{x^2+\sqrt{x^4+\sqrt{x^8+x^8\sqrt{1+...}}}}$$

$$=x+\sqrt{x^2+\sqrt{x^4+\sqrt{x^8\left(1+\sqrt{1+\cdots}\right)}}}$$

$$=x+\sqrt{x^2+\sqrt{x^4+x^4\sqrt{1+\sqrt{1+\cdots}}}}$$

$$=x+\sqrt{x^2+\sqrt{x^4\left(1+\sqrt{1+...}\right)}}$$

$$=x+\sqrt{x^2+x^2\sqrt{1+\sqrt{1+...}}}$$

$$=x+x\sqrt{1+\sqrt{1+\sqrt{1+...}}}$$

$$=x\left(1+\sqrt{1+\sqrt{1+\sqrt{1+...}}}\right)$$

Now

Let 1 + $\sqrt{1+\sqrt{1+\sqrt{1+\sqrt{1+...}}}}$ = y

$$\therefore 1+\sqrt{y}=y \Rightarrow \sqrt{y}=y-1$$

Squaring both sides

$y = y^2 + 1 - 2y$

$\Rightarrow y^2 - 3y + 1 = 0$

Then, $y=\frac{3\pm\sqrt{9-4}}{2}=\frac{3\pm\sqrt{5}}{2}$

$\because 1+\sqrt{1+\sqrt{1+...}}$ will be positive and equal to $\frac{3+\sqrt{5}}{2}$

$$\therefore x\left(1+\sqrt{1+\sqrt{1+...}}\right)=x\left(\frac{3+\sqrt{5}}{2}\right)$$

11. (c) Let the average of 13 innings be x.
13x + 108
$\Rightarrow$ 13x + 108 = 14x + 84
$\Rightarrow$ x = 24
$\Rightarrow$ His average after 14 innings
= 24 + 6 = 30

12. (c) Total run of Team A = 50 × 6.1 = 305
Team B needs in last ten over = 10 × 6.5
= 65 runs
So, Team B's score now = (305 – 65) = 240

13. (b) Consider Average of
1, 2, 3 → 2
Average of
1, 2, 3, 4, 5 → 3
Consider average of
2, 3, 4 → 3
Average of
2, 3, 4, 5, 6, → 4
So, the average increases by 1
New average becomes = k + 1

14. (a) Let Ronit's present age be x years.
Then, father's present age = (x + 3x) years
= 4x years.

$$\therefore (4x+8)=\frac{5}{2}(x+8)$$

$\Rightarrow$ 8x + 16 = 5x + 40
$\Rightarrow$ 3x = 24
$\Rightarrow$ x = 8.
Hence, required ratio

$$=\frac{(4x+16)}{(x+16)}=\frac{48}{24}=2$$

15. (a)

	Priya		Payel	
–3	6	:	5	
1				1
+7	7	:	6	

1 ratio = 3 + 7 = 10 years
Priya's present age = 6 × 10 + 3 = 63 years.
Payal's Present age = 5 × 10 + 3 = 53 years.
Ratio of their ages 17 years from now
= 63 + 17 : 53 + 17
= 80 : 70
= 8 : 7

16. (d) From questions–
5x + 3x + 5y + 7y = 1200
2x + 3y = 300 ...(i)

and $\frac{5x+5y}{3x+7y}=\frac{7}{5}$

x = 6y ...(ii)
From eqn. (i) and (ii)
x = 120

∴ Number of students before new admission = 8x = 960

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17. (b) $\frac{\text{Last year's salary of Mahesh}}{\text{Last year's salary of Suresh}} = \frac{3}{5}$

$\frac{\text{Present salary of Mahesh}}{\text{Present salary of Suresh}} = \frac{\left[3\times\frac{3}{2}\right]}{\left[5\times\frac{5}{4}\right]} = \frac{18}{25}$

ATQ, 18 units + 25 units = 43 units = Rs. 43000

1 unit = Rs. 1000

So, Mahesh's present salary = 18 units = Rs. 18000

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

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

x = 100

So, A's share = $\frac{5}{2}$(100 – 40) = Rs. 150

19. (b) Ratio of capitals, S : T = $\frac{1}{3}:\frac{2}{3}$ = 1 : 2

Ratio of profits, S : T = $\frac{3}{5}:\frac{2}{5}$ = 3 : 2

Let T's money was used for x moths.

∴ (1 × 9) : (2 × x) = 3 : 2

$\Rightarrow x = 3$ months

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20. (c) Investment of B → x

Investment of A → 3x

Time of B → y

Time of A → 2y

Profits Ratio = 3x × 2y : x × y

= 6xy : xy

= 6 : 1

1r → Rs. 4000

7r → Rs. 28000

Total Profit = Rs. 28000

21. (a) Let the initial investment of A and B is 18x & 7x respectively.

According to the question.

$\Rightarrow$(18x×12)+16000)/(7x×12)+56000)=2/1

x = 2000

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Total initial investment of A and B

= (18 + 7) × 2000 = Rs. 50000

22. (d)

w	x	y
132	100	A

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ATQ, $\frac{100 + A}{A} = \frac{100}{67}$

$A = \frac{6700}{33} = 203.03 \simeq 203$

$\text{Required\%} = \frac{203 - 132}{132} \times 100$

$= \frac{71\times 25}{33} = 53.8\%$ (Approx)

23. (b) Women = $\frac{43}{83}$ × 311250 = 161250

Men = 311250 – 161250 = 150000

Total number of literate person

$= \frac{161250\times 8}{100} + 150000\times\frac{24}{100}$ = 48,900

24. (c)

	Income	Expenditure	Savings
Old →	100	60	40
	↓ 40% increase	↓ 40% increase	
New →	140	84	56

% change in savings = $\frac{16}{40}$ × 100 = 40%

25. (c) Let B = 100 then A = 170, C = 170 × $\frac{29}{8.5}$ = 580

and D = 580 × $\frac{130}{100}$ = 754

After increment B = 129 and D = 754 × $\frac{129}{100}$

Required percentage $= \frac{754\times\frac{129}{100}}{129}\times 100 = 754\%$

26. (b)

27. (a) Let the CP of first, second and third houses be Rs. 100, Rs.200 and Rs.400 respectively.

Gain = 20 + 40 – 40 = Rs. 20

∴ Gain % $= \frac{20}{700}\times 100 = \frac{20}{7} = 2\frac{6}{7}$

28. (b) $12\frac{1}{2}\% = \frac{1}{8}, 14\frac{2}{7}\% = \frac{1}{7}$

Her overall gain percentage

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$= \frac{250\times\frac{1}{8} + 350\times\frac{1}{7}}{250 + 350}\times 100$

$=\frac{31.25+50}{600}\times100=\frac{8125}{600}\cong13.5\%$

29. (b) Let the cost price of each horse = 100
So, overall profit
= (35 × 27 + 40 × 17 + 10 × 13) = 1755
If total profit is 1755 then cost price of each horse = 100
If total profit is 12285 then cost price of each horse $=\frac{100}{1755}\times12285$ = Rs. 700

30. (b) A.T.Q.
$x\times\frac{6}{5}\times\frac{6}{5}\times\frac{5}{6}=600$
x = 500

31. (b) $P = M - D - \frac{MD}{100}$
$25=M-20-\frac{20M}{100}$
$45=\frac{4M}{5}$
$M=\frac{225}{4}\%$
25% → 6000
100% → Rs. 24000
Advertised Price
$= 24000 + 24000 \times \frac{225}{400}$
= 24000 + 13500
= Rs. 37500

32. (c) SI for 10 years = 3130 & given that principal becomes 5 times after 5 years
P × r × t/100 = 3130
Pr/100 = 313
ATQ,
Total SI = P × r × 5/100 + 5P × r × 5/100
$=\frac{Pr}{100}(5+25)=313\times30=9390$

33. (d) Let the principal = Rs. P
Time = 2 years
Amount = Rs. 2.25 P,
Let Rate = R%
By using formula,
$2.25P=P\left(1+\frac{R}{100}\right)^2$
$\frac{225}{100}=\left(1+\frac{R}{100}\right)^2$
$\left(\frac{15}{10}\right)^2=\left(1+\frac{R}{100}\right)^2$
$\frac{R}{100}=\frac{15}{10}-1$
$\Rightarrow\frac{R}{100}=\frac{5}{10}$
$R=50\%$

34. (d) Let the principal be Rs. P and rate of interest be R% per annum.
Difference of C.I. and S.I. for 2 years
$=\left[P\times\left(1+\frac{R}{100}\right)^2-P\right]-\left(\frac{P\times R\times2}{100}\right)=\frac{PR^2}{10^4}$
Difference of C.I. and S.I. for 3 years
$=\left[P\times\left(1+\frac{R}{100}\right)^3-P\right]-\left(\frac{P\times R\times3}{100}\right)=\frac{PR^2}{10^4}\left(\frac{300+R}{100}\right)$
$\therefore\frac{\frac{PR^2}{10^4}\left(\frac{300+R}{100}\right)}{\frac{PR^2}{10^4}}=\frac{25}{8}\Rightarrow\left(\frac{300+R}{100}\right)$
$\Rightarrow R=\frac{100}{8}=12\frac{1}{2}\%$

35. (a)

Borrow Money	Interest 20%	Amount	Money after Payback Rs. 1800
4000	800	4800	(4800 – 1800) = 3000
3000	600	3600	(3600 – 1800) = 1800
1800	360	2160	2160

At the end of third year or starting of 4th year he should pay Rs.2160 to clear all his dues.

36. (b)

A	10		6
B	15	60	4
C	20		3

Let the work completed in x days.
6(x – 1) + 4 × 3 + 3 × x = 60
6x – 6 + 12 + 3x = 60
9x = 54
x = 6
Ratio of share,
A : B : C
= 6 × 5 : 4 × 3 : 3 × 6
= 30 : 12 : 18 = 5 : 2 : 3
Share of $C=\frac{3}{10}\times3000=Rs.900$

37. (b) Dev, Manish and Ankit together can complete the work in 4 days.

Dev and Manish together can do it in $\frac{24}{5}$ days

Manish and Ankit together can do it in 8 days. Therefore, Dev alone can complete the work in

$$=\left(\frac{8\times4}{8-4}\right)\text{days}$$

= 8 days.

Manish alone can complete the work in

$$=\left(\frac{\frac{24}{5}\times8}{8-\frac{24}{5}}\right)\text{days}$$

= 12 days.

38. (d) Time taken by A = (x + 8) hours

Time taken by B = (x + $\frac{9}{2}$) hours

Work done together in one hour

$$=\frac{1}{x+8}+\frac{1}{x+\frac{9}{2}}$$

Required no. of hours

$$x=\frac{\left[(x+8)\left(x+\frac{9}{2}\right)\right]}{\left[2x+\frac{25}{2}\right]}=6\ \text{hours}$$

39. (d) 100 workers can complete one third work in 10 days

Therefore total work = 100 × 10 × 3

100 workers work for 10 days. Then 160 workers work for 8 days.

Let x workers will be discharged after 18th day. So (160 – x) workers do the remaining work in 5 days.

100 ×10 + 160 × 8 + (160 – x) × 5 =100 × 10 × 3

x = 16

40. (b) Till 3 pm, part of tank filled

$$=\frac{2}{8}+\frac{1}{12}=\frac{1}{4}+\frac{1}{12}=\frac{4}{12}=\frac{1}{3}\text{ part}$$

$\therefore$ Remaining part $=1-\frac{1}{3}=\frac{2}{3}$

Now, let x hr. be the time taken by all three pipes to fill the remaining part of tank

$$\left(\frac{1}{8}+\frac{1}{12}-\frac{1}{6}\right)x=\frac{2}{3}$$

$$\Rightarrow\frac{x}{24}=\frac{2}{3}$$

$\Rightarrow$ x=16 hr

Duration of time = 16 hr.

So tank will be filled at = 3pm + 16 hr.

= 7 am next day

41. (b) Let B be turned off after x minutes.

The, part filled by (A + B) in x min.

+ Part filled by A in (30 – x) min. = 1.

$$\therefore\ x\left(\frac{2}{75}+\frac{1}{45}\right)+(30-x)\cdot\frac{2}{75}=1$$

$$\Rightarrow\frac{11x}{225}+\frac{(60-2x)}{75}=1$$

$\Rightarrow$ 11x + 180 – 6x = 225.

$\Rightarrow$ x = 9.

42. (a) A + B together takes 36 mins to fill the tank.

$\frac{1}{60}+\frac{1}{90}=\frac{180}{5}$ = 36 min.

To fill the tank upto 3/4 height, pipes will take

= $\frac{3}{4}$ × 36 = 27 min.

So they will take 9 min to fill the left 1/4 of the tank.

For remaining 9 min $=\frac{1}{9}-\frac{1}{36}$ = 12 min.

Total = 27 + 12 = 39 min.

43. (d) Time taken by one tap to fill half of the tank = 3 hrs.

Part filled by 4 taps in 1 hour = 4 x 1/6 = 2/3

Remaining part = 1 – 1/2 = 1/2

2/3 : 1/2 :: 1 : p

p = 1/2 × 1 × 3/2 = 3/4 hrs. i.e., 45 min

So, total time taken = 3 hrs 45 min.

44. (a) We know that

$$\frac{S_1}{S_2}=\sqrt{\frac{t_2}{t_1}}\Rightarrow\frac{30}{S_2}=\sqrt{\frac{225}{196}}$$

S_2 = 14 × 2 = 28 km/h

45. (d) Speed of train 20% faster than the car

So, $6\left(t-\frac{12.5}{60}\right)=5t$

$t=1\frac{1}{4}$ hr.

Speed of car $=\frac{75}{t}=\frac{75}{\frac{5}{4}}=60\ \text{km/hr}$

46. (b) Speed of horse → x

Speed of train = 3x

Speed of train = 1.5 × speed of steamer

3x = 1.5 × speed of steamer

2x = speed of steamer

ATQ,

$$\frac{120}{2x}+\frac{450}{3x}+\frac{60}{x}=13\frac{30}{60}$$

$$\frac{60}{x}+\frac{150}{x}+\frac{60}{x}=\frac{27}{2}$$

$$\frac{270}{x}=\frac{27}{2}\quad \therefore\ x = 20$$

Speed of train = 3 × 20 = 60 km/hr

47. (a) Water that leaks in 5.5 min = 2.25 tones

$\therefore$ Water that leaks in 60 min $=\frac{2.25}{5.5}\times 60$

$=\frac{1350}{55}$ tones

After pumping water that is left in boat in 60 min.

$$=\frac{1350}{35}-12=\frac{690}{55}$$

$\therefore$ 92 tones water that remains in boat in

$\frac{55}{690}\times 92=\frac{22}{3}$ hr

$\therefore$ Required speed $=\frac{77}{\frac{22}{3}}$ = 10.5 km/h

48. (c) Case I: When accident occurs at 30 kms.

Usual time taken by train to cover remaining distance = 45 × 4 = 180 min

Case II : When accident occurs at 48 kms.

Usual time taken by train to cover remaining distance = 36 × 4 = 144 min

In (180 – 144) = 36 min., train covers 18 kms.

Hence speed of train = 18/36×60=30 km/hr

49. (c) Ratio of Crude oil to Petrol in the jar = 40 : 60 = 2 : 3

Ratio of Crude oil to Petrol in the new mixture = 26 : 74 = 13 : 37

Now, applying the given allegation method, we have

$\frac{2}{5}$ $\frac{19}{100}$

$\frac{13}{50}$

$\frac{7}{100}$ $\frac{7}{50}$

1 2

$\therefore$ Quantity of Petrol replaced $=\frac{2}{1+2}=\frac{2}{3}$

50. (d) Pulp in grapes = 3.4 × $\frac{20}{100}$

So, required answer $=\frac{3.4}{5}\times\frac{100}{85}$ = 0.8 kg

51. (b) Let the ratio be x : y

Let amount mixed be xk and yk

ATQ

2xk + 5yk = (xk + yk)4

$\Rightarrow$ y = 2x

$\Rightarrow$ x/y = 1/2

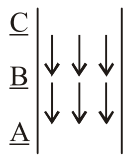
52. (d) Amount of milk left after 3 operations

$=\left[40\left(1-\frac{4}{40}\right)^3\right]$ litres

$=\left(40\times\frac{9}{10}\times\frac{9}{10}\times\frac{9}{10}\right)$ = 29.16 litres.

53. (b) Let speed of boat = S_B

Speed of steam = S_S



Let AB = D km then

BC = D km

AC = 2D km

$$\frac{D}{S_B-S_S}+\frac{D}{S_B+S_S}=\frac{13}{2} \quad ...(i)$$

$$\frac{2D}{S_B-S_S}=9 \quad ...(ii)$$

So $\frac{D}{S_B-S_S}=\frac{9}{2}$ ...(iii)

From (i) and (iii) we get

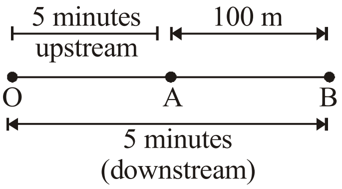
$$\frac{9}{2}+\frac{D}{S_B+S_S}=\frac{13}{2}$$

$$\frac{D}{S_B+S_S}=2$$

To go from C to A it takes

$$\frac{2D}{S_B+S_S}=4 \text{ hours}$$

54. (d)



Let y $\Rightarrow$ Speed of current,

x $\Rightarrow$ Speed of swimmer in still water

$$OA=\frac{5}{60}(x-y)$$

$$OB=\frac{5}{60}(x+y)$$

$AB = OB - OA$

$$\frac{100}{1000}=\frac{5}{60}(x+y)-\frac{5}{60}(x-y)$$

$6 = 5x + 5y - 5x + 5y$

$10y = 6$

$y = 0.6$ km/hr

55. (c) Downstream speed $\Rightarrow x + y = d/3$

$d = 3(x + y)$ ...(i)

Upstream speed

$$\Rightarrow x-y=\frac{d\times 2}{7}$$

$$d=\frac{7}{2}(x-y) \quad \text{...(ii)}$$

$$\frac{7}{2}(x-y)=3(x+y)$$

$7x - 7y = 6x + 6y$

$x = 13y$ ...(iii)

y $\Rightarrow$ speed of water = 1.5 km/hr.

$x = 13 \times 1.5$

= 19.5 km/hr.

56. (a) Speed downstream = (5 + 1) kmph = 6 kmph.

Speed upstream = (5 - 1) kmph = 4 kmph.

Let the required distance be *x* km.

Then, $\frac{x}{6}+\frac{x}{4}=1$

$\Rightarrow 2x + 3x = 12$

$\Rightarrow 5x = 12$

$\Rightarrow x = 2.4$ km.

57. (c) Minimum value of $a \sin^2\theta + b \operatorname{cosec}^2\theta$ is

$2\sqrt{ab}$ (if $a \geq b$) and $a + b$ (if $a \leq b$)

Now, here $a < b$,

So, minimum value = 7 + 14 = 21

58. (a) As the given expression is of the form of

$$a\sec\theta - b\tan\theta=\sqrt{a^2-b^2}$$

Then $\sec\theta=\frac{a}{\sqrt{a^2-b^2}}$ & $\tan\theta=\frac{b}{\sqrt{a^2-b^2}}$

$$\sec\theta=\frac{6}{\sqrt{32}}$$

$$\sec\theta=\frac{3}{2\sqrt{2}}$$

59. (b) $4n\,\alpha = \pi \Rightarrow 2n\alpha = \pi/2$

Now,

$\cot\alpha.\cot(2n-1)\alpha = \cot\alpha.\cot\left(\frac{\pi}{2}-\alpha\right) = \cot\alpha.$

$= 1$

Similarly,

$\cot 2\alpha.\cot(2n-2)\alpha = 1$

$\cot 3\alpha.\cot(2n-3)\alpha = 1$

$\cot\alpha.\cot 2\alpha.\cot 3\alpha. \ldots. \cot(2n-1)\alpha$

$= [\cot\alpha.\cot(2n-1)\alpha]\,[\cot 2\alpha.\cot(2n-2)\alpha]\,\ldots\ldots..[\cot(n-1)\alpha.\cot(n+1)\alpha]$

$= 1.1\ldots\ldots..1 = 1$

60. (c) $x\sin^2 60° - \frac{3}{2}\sec 60° \tan^2 30° + \frac{4}{5}\sin^2 45° \tan^2 60° = 0$

$$x\times\left(\frac{\sqrt{3}}{2}\right)^2-\frac{3}{2}\times 2\times\left(\frac{1}{\sqrt{3}}\right)^2+\frac{4}{5}\times\left(\frac{1}{\sqrt{2}}\right)^2.\left(\sqrt{3}\right)^2=0$$

$$\frac{3}{4}x-3\times\frac{1}{3}+\frac{4}{5}\times\frac{1}{2}\times 3=0$$

$$\frac{3}{4}x-1+\frac{6}{5}=0$$

$$\frac{15x-20+24}{20}=0$$

$$15x+4=0,$$

$$x=\frac{-4}{15}$$

61. (b) $\sin^2\Phi = \sin\theta\cos\Phi$

or $1 - \cos 2\theta = \sin 2\Phi$

or $\cos 2\theta = 1 - \sin 2\Phi = 1 + \cos\left(\frac{\pi}{2} + 2\phi\right)$

or $\cos 2\theta = 2\cos^2\left(\frac{\pi}{4} + \phi\right)$

62. (b) $\left[\frac{\cos^2 A(\sin A + \cos A)}{\csc^2 A(\sin A - \cos A)}\right] +$

$\left[\frac{\sin^2 A(\sin A - \cos A)}{\sec^2 A(\sin A + \cos A)}\right](\sec^2 A - \csc^2 A)$

$= \frac{\cos^2 A \cdot \sin^2 A(\sin A + \cos A)}{(\sin A - \cos A)} +$

$\left[\frac{\sin^2 A \cdot \cos^2 A(\sin A - \cos A)}{(\sin A + \cos A)}\right]\left[\frac{1}{\cos^2 A} - \frac{1}{\sin^2 A}\right]$

$= \left[\frac{(\sin A + \cos A)^2 + (\sin A - \cos A)^2}{\sin^2 A - \cos^2 A}\right] \times$

$(\sin^2 A - \cos^2 A)$

$= 2$

63. (a)

$$\frac{(\sin\theta + \cos\theta)(1 - \sin\theta)\frac{(1 + \sin\theta)}{\cos\theta}\sec\theta}{\left[\sin\theta\frac{(\sin\theta + \cos\theta)}{\cos\theta} + \cos\theta\frac{(\sin\theta + \cos\theta)}{\sin\theta}\right]\sin\theta\cos\theta}$$

$$= \frac{\frac{1 - \sin^2\theta}{\cos^2\theta}}{\left[\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}\right]\sin\theta\cos\theta} = 1$$

64. (b) Let x = 30º

$$\frac{\sqrt{3}}{1 - \frac{1}{\sqrt{3}}} + \frac{\frac{1}{\sqrt{3}}}{1 - \sqrt{3}}$$

$$= \frac{3}{\sqrt{3} - 1} - \frac{1}{\sqrt{3}(\sqrt{3} - 1)}$$

$$= \frac{3\sqrt{3} - 1}{3 - \sqrt{3}}$$

$$= \frac{(3\sqrt{3} - 1) \times (3 + \sqrt{3})}{6}$$

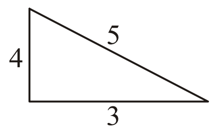
$$= \frac{9\sqrt{3} - 3 + 9 - \sqrt{3}}{6}$$

$$= \frac{8\sqrt{3} + 6}{6} = \frac{4\sqrt{3} + 3}{3} = \frac{4}{\sqrt{3}} + 1$$

So, (b) option

$$= \frac{4}{\sqrt{3}} + 1$$

65. (c) $\sin x = \frac{4}{5}$



So, $\left(\frac{\frac{4}{3} - \frac{3}{4}}{\frac{5}{3} - \frac{4}{3}}\right)\left(\frac{\left(\frac{3}{5}\right)^4 - \left(\frac{4}{5}\right)^4}{2 \times \left(\frac{3}{5}\right)^2 - 1}\right) = 7/4$

66. (d) $a\sin\theta + b\cos\theta = m$ ...(i)

Let $a\cos\theta - b\sin\theta = 6x$ ...(ii)

Squaring and adding (i) and (ii)

$a^2\sin^2\theta + b^2\cos^2\theta + 2ab\sin\theta\cos\theta + a^2\cos^2\theta + b^2\sin^2\theta - 2ab\sin\theta\cos\theta$

$= m^2 + 36x^2$

$= a^2(\sin^2\theta + \cos^2\theta) + b^2(\cos^2\theta + \sin^2\theta) = m^2 + 36x^2$

$= a^2 + b^2 = m^2 + 36x^2$

$= 36x^2 = a^2 + b^2 - m^2$

$x = \pm\frac{1}{6}\sqrt{a^2 + b^2 + m^2}$

67. (a) Max. value of $\sin\theta = 1$

So, $\sin^3\theta + 2\sin^2\theta + 3\sin\theta$

$= 1 + 2 + 3 = 6$

At $\theta = 0°$, $\sin\theta = 0$

$\sin^3\theta + 2\sin^2\theta + 3\sin\theta = 0$

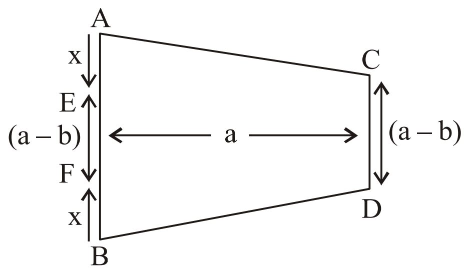
So, statement (1) is correct.

68. (c) Volume of metal $= \pi \times 28 \times (r^2 - 8^2)$

$1496 = \pi \times 28(r^2 - 8^2)$

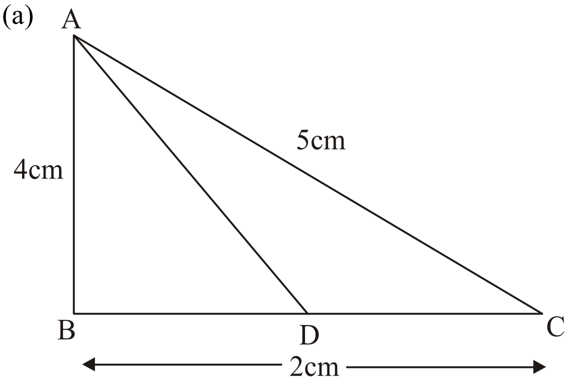
r = 9 cm

69. (d)



AC = BD
AE = BF = x (let)
AB = (a – b) + 2x
a + b = a – b + 2x
x = b
Now, In ΔACE,
$x^2 + a^2 = AC^2$
$AC^2 = b^2 + a^2$
$\Rightarrow AC = \sqrt{b^2 + a^2}$

70. (a)



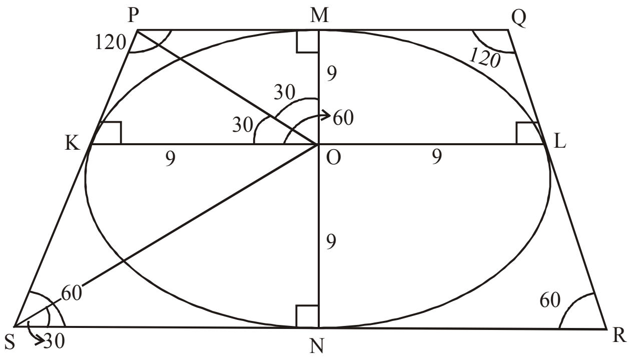
By Apollonius theorem –

$$AD = \sqrt{\frac{2AB^2 + 2AC^2 - BC^2}{4}}$$

$$\sqrt{\frac{32 + 50 - 4}{4}}$$

$$AD = \sqrt{\frac{39}{2}}$$

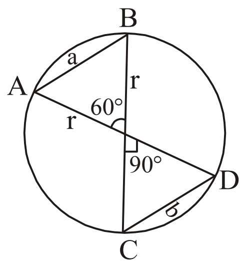
71. (c) Here given a diagram as shown in the question



$\angle RSP = \angle SRQ = 60^o$ (Given)
$\angle PQR = \angle QPS = 120^o$ (Given)
In a quadrilateral PMOK
$\angle MOK = 180^o – 120^o = 60^o$
$\angle POM = \angle KOP = 30^o$
OK = OM = 9 cm (Given)

In ΔPOM
tan 30 = PM/9 $\Rightarrow$ PM = $3\sqrt{3}$ = PK = MQ = QL
Similarly In ΔSON
tan 30 = ON/SN
SN = $9\sqrt{3}$ = SK = NR = RL
So, perimeter PQRS
$= 3\sqrt{3}\times4+9\sqrt{3}\times4$
$= 4 \times 12\sqrt{3}$
$= 48\sqrt{3}$

72. (a)



OC = OD = OB = OA = radius = r
$\Rightarrow$ In ΔCOD
$b^2 = 2r^2$
$\Rightarrow r = \frac{b}{\sqrt{2}}$
And ΔAOB = equilateral triangle
Hence, a = r

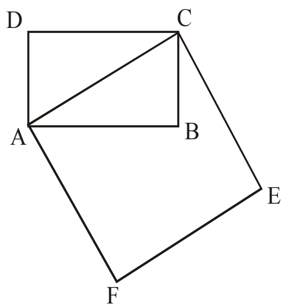
$r = \frac{b}{\sqrt{2}}$, Hence $b = \sqrt{2}a$

$\Rightarrow 2a^2 - b^2 = 0$

73. (a) $\because r_a > r_b > r_c$

$\Rightarrow \frac{\Delta}{s-a} > \frac{\Delta}{s-b} > \frac{\Delta}{s-c}$
$\Rightarrow s – a < s – b < s – c$
$\Rightarrow –a < –b < –c$
$\Rightarrow a > b > c$

74. (a)



ABCD $\rightarrow$ rectangle

ACEF → square
Let AB - a cm, BC - b cm
ATQ,
a + b = 15 cm ...(i)
and,
Diagonal of rectangle

$= \sqrt{a^2+b^2} = \text{side of square}$

$$\frac{\text{Area of square}}{\text{Area of rectangle}} = \frac{\left(\sqrt{a^2+b^2}\right)^2}{ab}$$

$$\Rightarrow \frac{13}{6} = \frac{a^2+b^2}{ab}$$

$$\Rightarrow \frac{13}{12} = \frac{a^2+b^2}{2ab}$$

$\Rightarrow$ Applying componendo dividendo

$$\Rightarrow \frac{13+12}{13-12} = \frac{a^2+b^2+2ab}{a^2+b^2-2ab}$$

$$\Rightarrow \frac{25}{1} = \frac{(a+b)^2}{(a-b)^2}$$

$$\Rightarrow (a-b)^2 = \frac{(15)^2}{25}$$

$$\Rightarrow (a-b)^2 = \frac{225}{25} = 9$$

$$\Rightarrow (a-b) = 3$$

$\therefore$ Area of square $= a^2+b^2$

$$= \frac{1}{2}\left[(a+b)^2+(a-b)^2\right]$$

$$= \frac{1}{2}\left[(15)^2+(3)^2\right]$$

$$= \frac{1}{2}[225+9] = \frac{234}{2} = 117 \text{ cm}^2$$

75. (d) $B = 2, C = \sqrt{3}, \angle A = 30^\circ$

$$A = \sqrt{B^2+C^2-2BC\cos A}$$

$$A = \sqrt{4+3-2.2.\sqrt{3}.\frac{\sqrt{3}}{2}}$$

$= 1$

$$\therefore S = \frac{A+B+C}{2} = \frac{3+\sqrt{3}}{2}$$

and $\Delta = \frac{1}{2}BC\sin A$

$$= \frac{1}{2}\times 2\times\sqrt{3}\times\frac{1}{2}$$

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

$$r = \frac{\Delta}{S} = \frac{\sqrt{3}}{3+\sqrt{3}}$$

$$= \frac{1}{\sqrt{3}+1}$$

$$= \frac{\sqrt{3}-1}{2}$$

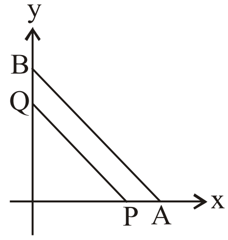
76. (b) Sum of interior angles of pentagon
= (5 – 2) × 180º = 540º
x + 2x + 3x + 4x + 140 = 540
x = 40
So, difference between second largest and second smallest angle is = 140 – 80 = 60º

77. (b) Each interior angle of polygon $= \frac{(n-2)180^\circ}{n}$
= 60°, when n = 3,
= 90°, when n = 4,
= 108°, when n = 5,
= 120°, when n = 6,
= 135°, when n = 8,
= 140°, when n = 9,
= 144°, when n = 10,
= 150°, when n = 12

78. (c) Since number of diagonals in n sided polygon
= n(n – 3)/2
For, n = 10,
Number of diagonals
= (10×7)/2=35

79. (b) $OP = \sqrt{(2-0)^2+(0-2)^2} = 2$

$$OQ = \sqrt{(0-0)^2+(3/2-0)^2} = 3/2$$



$$PQ = \sqrt{OP^2+OQ^2}$$

$$= \sqrt{4+\left(\frac{3}{2}\right)^2} = \sqrt{\frac{25}{4}} = 2.5 \text{ cm}$$

80. (b) $L \Rightarrow 2x - y = 0$

For (0, 1) L' = –1

L' < 0

For $\left(\frac{4}{5},\frac{3}{5}\right)$

$L'' = \frac{8}{5} - \frac{3}{5} = 1$

L'' > 0

Hence both points lie on opposite side of the line.

81. (c) If centroid is at origin then,

$\frac{a+b+c}{3} = 0$

(a + b + c) = 0

Hence, $a^3 + b^3 + c^3 - 3abc = 0$

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

82. (a) As we know that

$x = \frac{mx_2 + nx_1}{(m+n)}$

$y = \frac{my_2 + ny_1}{(m+n)}$

For y = 0,

$0 = \frac{m\times(-3) + n\times 6}{m+n}$

$\frac{m}{n} = \frac{6}{3} = \frac{2}{1}$

83. (b) The required coordinates of the point which divides the in the ratio 5 : 3 are

$\left(\frac{mx_2 - nx_1}{m-n}, \frac{my_2 - ny_1}{m-n}\right)$

Here, m : n = 5 : 3, $(x_1, y_1) = (2, 4)$, $(x_2, y_2) = (6, 8)$

Hence the required co-ordinates = (12, 14)

84. (d) Let $x_1 = -5$, $x_2 = 4$, $x_3 = 4$

$y_1 = 7$, $y_2 = -1$, $y_3 = -1$

Area of triangle formed by given points

$= \frac{1}{2}\left[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)\right]$

$= \frac{1}{2}[(-5)\{-1 - (-1)\} + (4)(-1 - 7) + 4\{7 - (-1)\}]$

= 0

Hence the example three points are not forming any triangle, rather they are collinear.

85. (c) Let the coordinate of the moving point P be (h, k).

Then, $[h-(m+n)]^2 + [k-(n-m)]^2$

$= [h-(m-n)]^2 + [k-(n+m)]^2$

$\Rightarrow h^2 + (m+n)^2 - 2h(m+n) + k^2 + (n-m)^2 - 2k(n-m)$

$= h^2 + (m-n)^2 - 2h(m-n) + k^2 + (n+m)^2 - 2k(m+n)$

$\Rightarrow -2[h(m+n) + k(n-m)] = -2[h(m-n) + k(m+n)]$

$\Rightarrow mh + nh + nk - mk = mh - nh + mk + nk$

$\Rightarrow 2nh = 2mk \Rightarrow nh = mk$

$\therefore$ Required locus is $nx = my$

86. (b)

Mark's Gap	No. of Students
0 – 10	30
10 – 20	22
20 – 30	13
30 – 40	16
40 above	26

No. of Students b/w 20 to 40 marks = 29

87. (a) Total audience of 2nd show = 300 + 450 + 700 = 1450

Total audience of 3rd show = 600 + 400 + 750 = 1750

Required increase% = $\frac{1750-1450}{1450} \times 100$ = 20.69%

88. (c) Percentage decrease $= \frac{32-27}{32}\times 100 = 15\frac{5}{8}\%$

89. (c) Total income from income tax and customs is $= \frac{3850\times 21}{100}$

Total expenditure on defense and central sector schemes $= \frac{2950\times 21}{100}$

Required % $= \frac{\frac{3850\times 21}{100} - \frac{2950\times 21}{100}}{\frac{2950\times 21}{100}} \times 100$

$= \frac{900\times 100}{2950} = 30.51\%$

90. (a) Required percent $= \frac{\frac{6+6+8}{3}}{\frac{20+9}{2}} \times 100$

$= \frac{4000}{87}$ = 46% approx

91. (d) Required Ratio

$= \frac{3850(18+17+7)}{2950(13+18)} = \frac{3234}{1829}$

92. (b) Average $= \frac{100}{8} = 12\frac{1}{2}\%$

Required sector = 4

93. (a) Difference between runs scored by Jadeja and Rahane

Match I = 25-20 = 5

Match II = 15-0 = 15

Match III = 70-30 = 40

Match IV = 40-35 = 5

Maximum difference = 40 runs.

94. (b) Total runs scored by all the batsmen in all 4 matches.

1. Dhoni = 10+50+35+60 =155
2. Jadeja = 25+15+70+40 = 150
3. Kohli = 40+35+55+50 = 180
4. Rahane = 20+0+30+35 = 85

Least runs are scored by Rahane.

95. (b) $x^2 - x - 6$

$\Rightarrow (x-3)(x+2)$

$\therefore$ The expression $(px^3 - qx^2 - 7x - 6)$ will result 0 at x = 3 and x = –2 as it is divisible by (x – 3) and (x + 2)

At $x = 3 \Rightarrow (3)^3p - (3)^2q - 7 \times (3) - 6 = 0$

$27p - 9q = 27$ ...(i)

At $x = -2 \Rightarrow (-2)^3p - (-2)^2q - 7 \times (-2) - 6 = 0$

$-8p - 4q = -8$ ...(ii)

On solving (i) and (ii) we get, p = 1 and q = 0

96. (a) $-1 + 2 + 5a - 7 = R_1 \Rightarrow 5a - 6 = R_1$ and $8 + 4a - 24 + 6 = R_2 \Rightarrow 4a - 10 = R_2$

$\therefore 10a - 12 + 4a - 10 = 6$

$\Rightarrow 14a = 28$

$\Rightarrow a = 2$

97. (a) Clearly ±1 are the zeros of given equation,

For x = 1;

a + b + c + d +e = 0

& for x = –1;

a – b + c – d + e = 0

or a + c + e = b + d

98. (a) Let zeroes be, $a \& \frac{1}{a}$

$\therefore a + \frac{1}{a} = \frac{17}{k^2}$

$\& \ 1 = \frac{k+2}{k^2}$

$\Rightarrow k^2 - k - 2 = 0$

$\Rightarrow k^2 - 2k + k - 2 = 0$

$\Rightarrow (k-2)(k+1) = 0$

$\Rightarrow k = 2 \quad (\because k > 0)$

99. (d) $x^3 - ax^2 + bx - a = 0$

$\Rightarrow x(x^2 + b) - a(x^2 + 1) = 0$

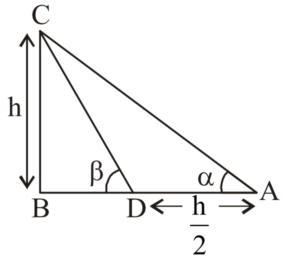
If b = 1, then

$(x - a)(x^2 + 1) = 0$

Then $x^2 = -1 \Rightarrow$ imaginary roots of the given equation

$\therefore b \neq 1$

100. (c)



In ΔCBD,

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

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

In CBA,

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

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

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

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

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

★★★