# RATES, RATIOS, PROPORTION AND PERCENTAGES.

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# K.C.S.E. SAMPLE SOLVED QUESTIONS.

1) In a class there are thrice as many boys as girls $\frac{1}{3}$ of the boys are from poor families while $\frac{1}{5}$ of the girls are from rich families. Find the percentage number of pupils from rich families in the class. (3marks)

**Let Girls $= x$**

**Boys $= 3x$**

**Total number of student $= 4x$**

**Poor family;**

$\frac{1}{3}$ **of boys;**

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

$= x$

$\frac{4}{5}$ **of girls;**

$= \frac{4}{5}x$

**Rich families**

$\frac{2}{3}$ **of boys;**

$= \frac{2}{3} \times 3x$

$= 2x$

$\frac{1}{5}$ **of girls;**

$= 0.2x$

**Tota number of student from rich family;**

$= 2x + 0.2x$

$= 2.2x$

$\% = \frac{2.2x}{4x} \times 100$

$= 55\%.$

2) The scale of a map is given as $1:50{,}000$. Find the actual area in hectares of a region represented by a triangle of sides 6cm by 7cm (Give your answer to the nearest whole number). (3 marks)

$$\text{Area} = \frac{1}{2}bh$$

$$= \left\{\frac{1}{2} \times \left(\frac{6 \times 50000}{100}\right) \times \left(\frac{7 \times 50000}{100}\right)\right\} m^2$$

$$= 5250000 m^2$$

$$10000\ m^2 = 1\ ha$$

$$\therefore 5250000\ m^2$$

$$= 525\ ha.$$

3) Thirty men working at the rate of 10 hours a day can complete a job in 14 days. Find how long it would take 40 men working at the rate of 7 hours a day to complete the same job. (3marks)

**Number of men increases from 40: 30**

**Therefore;**

**The number of men taken decreases**

**30: 40**

**The number of hours decreases 7: 10**

**Therefo;**

$$\frac{40}{40} \times \frac{10}{7} \times 14$$

$$= 15 \text{ days}.$$

4) Three bells ring at intervals of 12 minutes 15 minutes and 18 minutes. If they sound together at 10.00 am, at what time did they lastly sound together. (3marks)

**LCM of 12, 15 and 48**

| | | | |
|---|---|---|---|
| 2 | 12 | 15 | 18 |
| 2 | 6 | 15 | 9 |
| 3 | 3 | 15 | 9 |
| 3 | 1 | 5 | 3 |
| 5 | 1 | 5 | 1 |
| | 1 | 1 | 1 |

$$= 2 \times 2 \times 3 \times 3 \times 5$$

$$= 180 \text{ minutes}$$

$$= \left(\frac{180}{60}\right) \text{hrs}$$

$$= 3 \text{ hrs}$$

$$\begin{array}{r} 1000 \\ 0300 \\ \hline 1300 \end{array} +$$

$$= 1{:}00 \text{ pm}.$$

5) The length of a rectangle is increased by 25% while its width is decreased by 5%. Determine the percentage increase in the area of the rectangle. (3marks)

$$\text{New area} = \frac{125}{100}\text{L} \times \frac{95}{100}\text{W}$$

$$= 1.1875\text{LW}$$

$$\text{Original area} = \text{LW}$$

**% change;**

$$= \left(\frac{1.1875\text{LW} - \text{LW}}{\text{LW}}\right) \times 100$$

$$= 18.75\%.$$

6) A group of 10 soldiers set off with enough food to last 7 days. After 4 soldiers deserted. How many more days will the food last for the remaining soldiers? (3 marks)

$$\frac{10 \times 7}{6}$$

$$= 11\frac{2}{3} \text{ days}$$

$$11\frac{2}{3} - 7$$

$$= 4\frac{2}{3} \text{ days.}$$

7) A business woman bought 300 oranges at Sh. 10 for every twelve oranges. Twelve of them got bad but she sold the remaining at Ksh. 20 for every 18 oranges. Calculate the percentage profit. (3 marks)

$$\frac{10 \times 300}{12}$$

$$= \text{sh. } 250$$

**Remaining Oranges**

$$= 288$$

$$\frac{20 \times 288}{18}$$

$$= \text{sh. } 320$$

% change;

$$= \left(\frac{320 - 250}{250}\right) \times 100$$

$$= 28\%.$$

8) The cost of providing a commodity consists of transport, labour and raw material in the ratio 8: 4: 12 respectively. If the transport cost increases by 12% labour cost 18% and raw materials by 40%, find the percentage increase of producing the new commodity. (3 marks)

Let the cost be C;

T: L: R
8: 4: 12

New prices;

$$\text{Transport} = \frac{112}{100}\left(\frac{8}{24}\text{C}\right)$$

$$= \frac{28}{75}\text{C}$$

$$\text{Labour} = \frac{118}{100}\left(\frac{4}{24}\text{C}\right)$$

$$= \frac{59}{300}\text{C}$$

$$\text{Raw material} = \frac{140}{100}\left(\frac{4}{24}\text{C}\right)$$

$$= \frac{7}{10}\text{C}$$

$$\text{Total New cost} = \left(\frac{28}{75}\text{C} + \frac{59}{300}\text{C} + \frac{7}{10}\text{C}\right)$$

$$= \frac{127}{100}\text{C}$$

$$= 1.27\text{C}$$

% increase;

$$= \left(\frac{1.27\text{C} - \text{C}}{\text{C}}\right)100$$

$$= 27\%.$$

9) A man is $2\frac{4}{5}$ times his son's age now. Four years ago the ratio of the ages of father to son was 4: 1. What will be the ratio of their ages two years from now? (4marks)

**New;**

$$\text{Son} = x \text{ yrs}$$

$$\text{Man} = \frac{14}{5}x \text{ yrs}$$

**4 years Ago;**

$$\text{Son} = (x-4)\text{yrs}$$

$$\text{Father} = \left(\frac{14}{5}x - 4\right)\text{yrs}$$

$$\text{Man: Son} = 4:1$$

$$\frac{\left(\frac{14}{5}x - 4\right)}{(x-4)} = \frac{4}{1}$$

$$4(x-4) = \left(\frac{14}{5}x - 4\right)$$

$$4x - 16 = \frac{14}{5}x - 4$$

$$4x - \frac{14}{5}x = -4 + 16$$

$$1.2x = 12$$

$$x = 10$$

**2 years from Now**

$$\text{Son} = 10 + 2$$

$$= 12 \text{ years}$$

$$\text{Father: Son} = 30:12$$

$$= 5:2.$$

10) Three business people, Mutua, Kamau and Mwiti contributed a total of ksh. 164,500 to start a retail business. The ratio of contribution of Mutua to Kamau was 2 ： 3, that of Kamau to Mwiti was 4 ： 5. How much did Mutua contribute? (3 Marks)

$$\text{Mu: Ka}$$
$$2:3$$

$$\text{Ka: Mw}$$
$$4:5$$

$$\text{Mu: Ka}$$
$$4(2:3)$$

$$\text{Ka: Mw}$$
$$3(4:5)$$

$$\text{Mu: Ka}$$
$$8:12$$

$$\text{Ka: Mw}$$
$$12:15$$

$$\text{Mu: Ka: Mw}$$
$$8:12:15$$

**Total contribution is 165,500**

$$8 + 12 + 15 = 35$$

**Mutua contributions;**

$$\frac{8}{35} \times 164,500$$

$$= \text{sh. } 37600.$$

11) Mutua had a tank which had two taps A and B. Tap A takes $5\frac{1}{3}$ minutes to fill the tank and tap B takes 10 minutes to empty the tank. Starting with a tank $\frac{3}{4}$ full, how long will it take to fill the tank if both taps are opened at the same time? (4marks)

**Part of the tank filled by tap A in 1 minutes;**

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

**Part of the tank emptied by tap B in 1 hr;**

$$= \frac{1}{10}$$

**Part of the tank filled when bot taps are running;**

$$= \frac{3}{16} - \frac{1}{10}$$

$$= \frac{7}{80}$$

**Part of the tank remaining to be filled;**

$$= \frac{4}{4} - \frac{3}{4}$$

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

$$\frac{7}{80} = 1 \text{ minute}$$

$$\therefore \frac{1}{4}$$

$$= \frac{1}{4} \times \frac{80}{7}$$

$$= 2\frac{6}{7} \text{ minutes}.$$

12) In a fund-raising committee of 45 people, the ratio of men to women is 7: 2. Find the number of women required to join the existing committee so that the ratio of men to women is changed to 5: 4. (3marks)

**Ratio;**

**M: N**

**7: 2**

**Total ratio = 9**

**So men were;**

$$= \frac{7}{9} \times 45$$

$$= 35$$

**Women were;**

$$\frac{2}{9} \times 45$$

$$= 10$$

**New RAtio;**

**M: N**

**5: 4**

**Let the number of women joined be x**

**Total number of women;**

$$= 10 + x$$

**Total number of women = 35**

$$\frac{(35)}{(10+x)} = \frac{5}{4}$$

$$50 + 5x = 140$$

$$5x = 140 - 50$$

$$5x = 90$$

$$x = \frac{90}{5}$$

$$= 18 \text{ women}.$$

13) The ratio of Eunice's cows to goats is 5 : 4. On a certain market day he sold a $\frac{1}{4}$ of the goats and $\frac{1}{5}$ of the cows. If she had sold 5 more animals from the herd only $\frac{2}{3}$ of the original number could have been left. How many animals were there before the sale? (3marks)

$$\mathbf{C: G}$$
$$\mathbf{5: 4}$$

**Let the original number of animals be y**

$$\mathbf{Cows} = \frac{5}{9}\mathbf{y}$$

$$\mathbf{Goats} = \frac{4}{9}\mathbf{y}$$

**After sales;**

$$\mathbf{Cows} = \frac{4}{5}\left(\frac{5}{9}\mathbf{y}\right)$$

$$= \frac{4}{9}\mathbf{y}$$

$$\mathbf{Goats} = \frac{3}{4}\left(\frac{4}{9}\mathbf{y}\right)$$

$$= \frac{3}{9}\mathbf{y}$$

**Had she sells, 5 more animals;**

$$\left(\frac{4}{9}\mathbf{y} + \frac{3}{9}\mathbf{y}\right) - 5 = \frac{2}{3}\mathbf{y}$$

$$\frac{7}{9}\mathbf{y} - \frac{2}{3}\mathbf{y} = 5$$

$$\frac{1}{9}\mathbf{y} = 5$$

$$\mathbf{y = 45\ animals.}$$

14) School fees charged in three-day secondary schools this year compares as follows; school A charges $\frac{3}{4}$ of fees charged in school B. School B charges twice the fees charged in school C. If school C charges Ksh. 12,000, express fees charged in the three schools in the ratio of C: A: B. (3marks)

$$\mathbf{A: B: C}$$

**Let school B be x**

$$\mathbf{B = x}$$

$$\mathbf{A} = \frac{3}{4}\mathbf{x}$$

$$\mathbf{C} = \frac{\mathbf{x}}{2}$$

**C;**

$$\frac{\mathbf{x}}{2} = 12000$$

$$\mathbf{x = 24000}$$

**B;**

$$\mathbf{x = 12000}$$

**A;**

$$\frac{3}{4} \times 12000$$

$$= 18000$$

**Ratio;**

$$\mathbf{A: B: C}$$
$$\mathbf{18000: 240000: 12000}$$

$$\mathbf{3: 4: 2.}$$

15) Kipketer can cultivate a piece of land in 7 hrs while Wanjiku can do the same work in 5 hours. Find the time they would take to cultivate the piece of land when working together.

**Kipketer takes 7 hrs**

**Part of the work done by Kipketer in 1 hr;**

$$= \frac{1}{7}$$

**Wanjiku takes 5 hrs**

**Part of the work done by Wanjiku in 1 hr;**

$$= \frac{1}{5}$$

**Part of the work done altogether working;**

$$\frac{1}{7} + \frac{1}{5} = \frac{5+7}{35}$$

$$= \frac{12}{35}$$

$$\frac{12}{35} = 1 \text{ hr}$$

$$\therefore \text{Full work } \frac{35}{35}$$

$$= \frac{35}{35} \times \frac{35}{12}$$

$$2\frac{11}{12} \text{ hrs.}$$

16) Mogaka and Ondiso working together can do a piece of work in 6 days. Mogaka working alone, takes 5 days longer than Onduso. How many days does it take Onduso to do the work alone.

**Let Ondiso takes x days**

**Mogaka takes $(x + 5)$**

**Part of the work done by Ondiso;**

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

**Part of the work done by Mogaka;**

$$= \frac{1}{(x+5)}$$

**Part of the work done all working together;**

$$= \frac{1}{x} + \frac{1}{(x+5)}$$

$$= \frac{x+5+x}{x(x+5)}$$

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

$$x^2 + 5x = 12x + 30$$

$$x^2 - 7x - 30 = 0$$

$$S = -7x$$

$$P = -30x^2$$

$$f = -10x \text{ and } 3x$$

$$x^2 - 10x + 3x - 30 = 0$$

$$x(x-10) + 3(x-10) = 0$$

$$(x+3)(x-10) = 0$$

$$x = -3 \text{ hrs}$$

$$x = 10 \text{ hrs}$$

$$x \neq -3 \text{hrs}$$

$$\therefore x = 10 \text{ hrs.}$$

17) A certain amount of money was shared among 3 children in the ratio 7: 5: 3 the largest share was Ksh. 91. Find the

(a) Total amount of money

| | |
|---|---|
| **Ratio among children;** | **Ratio 7 = 91** |
| **7: 5: 3** | **: ratio 15;** |
| **Total ratio = 15** | $= \frac{15 \times 91}{7}$ |
| **If largest got 91;** | **= 195** |

(b) Difference in the money received as the largest share and the smallest share.

| | |
|---|---|
| **Smallest;** | **Difference between smallest and largest;** |
| $\frac{3}{15} \times 195$ | **= 91 − 39** |
| **= sh. 39** | **= sh. 52.** |

18) Water flows from a tap at the rate of 27 $cm^3$ per second into a rectangular container of length 60 cm, breadth 30 cm and height 40 cm. If at 6.00 pm the container was half full, what will be the height of water at 6.04 pm?

| | | |
|---|---|---|
| **Volume of the container;** | $\begin{array}{r} 0604 \\ 0600 \\ \hline 0004 \end{array}$ | **= 6480 $cm^3$** |
| **= L × W × H** | **= 4 minutes** | **So volume will be;** |
| **= 60 × 30 × 40** | **= (4 × 60)s** | $\begin{array}{r} 36000 \\ 6480 \\ \hline 42480 \end{array}$ |
| **= 72000$cm^3$** | **= 240 s.** | **Therefore;** |
| **Half full will be;** | **If 1 s = 27 $cm^3$** | **60 × 30 × h = 42480** |
| $\frac{72000cm^3}{2}$ | **: . 240 s** | $h = \frac{42480}{60 \times 30}$ |
| **= 36000$cm^3$** | $= \frac{240 \times 7}{1}$ | **= 23. 6 cm.** |
| **Time different;** | | |

19) Three business men Kioko, Njau and Osiako are to share Sh. 12,000 in the ratio 5: 6: x respectively. If Kioko received Sh. 4,000, determine the value of $x$ (3mks)

$$\text{Total ratio} = 11 + x$$

$$\left(\frac{x}{11+x}\right) \times 12000 = 4000$$

$$\left(\frac{x}{11+x}\right) = \frac{1}{3}$$

$$3x = 11 + x$$

$$2x = 11$$

$$x = 5.5$$

20) A cylindrical water tank can be filled to a depth of 2.8 m by a pipe A in 2 hours. Pipe B takes 8 hours to fill the tank to the same depth. Pipe C can empty this amount in 6 hours.

(a) Starting with tank empty and pipe A running alone in one hour, find the depth of water it fills. (2 Marks)

$$\text{Depth} = 2.8;$$
$$\text{Filled by pipe A in 2 hrs}$$
$$\text{Filled by pipe B in 8 hrs}$$
$$\text{Pipe C ampty in 6 hrs}$$
$$\text{Part of the tank filled by pipe A in 1 hr};$$

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

$$\frac{1}{2} \times 2.8$$

$$= 1.4 \text{ m}.$$

.

(b) If pipe A is turned off and pipe C left open for one hour, what will be the new depth of water? (3 Marks)

$$\text{Part of the tank emptied by pipe C in 1 hr};$$

$$= \frac{1}{6}$$

$$\frac{1}{2} - \frac{1}{6} = \frac{1}{3}$$

$$\frac{1}{3} \times 2.8$$

$$= \frac{14}{15} \text{ m}.$$

(c) If the tank is initially empty and pipe A and B are both running while pipe C is left open, after how long will the depth of water reach 2m? (5 Marks)

$$\text{Part of the tank filled in 1 hr};$$
$$\text{when both taps are running};$$

$$\left(\frac{1}{2} + \frac{1}{8}\right) - \frac{1}{6}$$

$$= \frac{11}{24}$$

$$\frac{11}{24} \times 2.8$$

$$= \frac{77}{60} \text{ m}$$

$$\text{If 1 hr} = \frac{77}{60} \text{ m}$$

$$\therefore 2\text{m}$$

$$= 2 \div \frac{77}{60}$$

$$= 2 \times \frac{60}{77}$$

$$= 1 \text{ hr } 34 \text{ minutes}.$$

21) A trader purchases four 25 kg bags of sugar and packages the sugar in 2 kg, 1kg and 0.5 kg packs to be sold in retail. The trader does the packaging in a ratio of 3: 2: 5 respectively. He makes a profit of Ksh. 10 for every 2 kg pack, Ksh. 8 for the 1 kg pack and Kshs 6 for the 0.5 kg pack.

(a) Determine;

(i) The number of packets the trader made for each type of package. (3 marks)

**Number of packets in 2 kg;**

$$= \frac{3}{10} \times 100$$

$$= 30 \text{ kg}$$

$$\frac{30}{2} \text{ kg}$$

$$= 15 \text{ packets}$$

**Number of parckets in 1 kg**

$$= \frac{2}{10} \times 100$$

$$= 20 \text{ kg}$$

$$= 20 \text{ packets}$$

**Number of packets in 0.5 kg;**

$$= \frac{5}{10} \times 100$$

$$= 50 \text{ kg}$$

$$\frac{50}{0.5} \text{ kg}$$

$$= 100 \text{ packets}$$

(ii) The profit he will make if the wholesale price of a 25 kg bag of sugar is Ksh. 2000 (2marks)

**Profit made are;**

**2 kg packet at sh. 10**

**1 kg packet at sh. 8**

**0.5 kg packet at sh. 6**

**S. P;**

$$(15 \times 10) = 150$$

$$(20 \times 8) = 160$$

$$(100 \times 6) = 600$$

**Total S. P;**

$$= 150 + 160 + 600$$

$$= \text{sh. } 900.$$

(iii) The selling price of each type of package. (2 marks)

**25 kg cost 2000**

**1 kg cost**

$$\frac{2000}{25}$$

$$= \text{sh. } 80$$

**Cost of 2 kg will be;**

$$2 \times 80$$

$$= \text{sh. } 160$$

**Selling price** $= 160 + 10$

$$= \text{sh. } 170$$

**Cost of 1 kg will be;**

$$1 \times 80$$

$$= \text{sh. } 80$$

**Selling price** $= 80 + 8$

$$= \text{sh. } 88$$

**Cost of o. 5 kg will be;**

$$0.5 \times 80;$$

$$= \text{sh. } 40$$

**Selling price;**

$$= 40 + 6$$

$$= \text{sh. } 46.$$

(b) Determine his percentage profit. (3 marks)

$$\frac{\textbf{Profit}}{\textbf{Buying price}} \times 100$$
$$= \frac{910}{8000} \times 100$$
$$= 11.375\%.$$

22) In the year 2001 the price of a sofa set in a shop was Ksh. 12,000

(a) Calculate the amount received from the sales of 240 sofa sets that year (2 marks)

$$12000 \times 240$$

$$= \text{sh. } 2880000.$$

(b) In the year 2002 the price of each sofa set increased by 25% while the number of sets sold decreased by 10%.

(i) Calculate the percentage increase in the amount received from the sales (3 marks)

Each sofa;

$= \text{sh. } 12000$

$100\% = 12000$

$\therefore 125\%$

$$= \frac{125 \times 12000}{100}$$

$= \text{sh. } 15000$

No. of set are 240

Decrease by 10%

$100\% = 240 \text{ sets}$

$\therefore 90\%$

$$= \frac{90 \times 240}{100}$$

$= 216 \text{ sets}$

Year 2000;

Total amount;

$= 216 \times 15000$

$= \text{sh. } 3240000$

% increase;

$$= \left(\frac{3240000 - 2880000}{2880000}\right) \times 100$$

$$= \frac{360000}{2880000} \times 100$$

$= 12.5\%.$

(ii) If at the end of the year 2002, the price of each sofa set changed in the ratio 16: 15. Calculate the price of each sofa set in the year 2003. (2 marks)

$$\text{Ratio } 15 = \text{sh. } 15000$$
$$\therefore \text{Ratio } 16$$
$$= \frac{16 \times 15000}{15}$$
$$= \text{sh. } 16000.$$

(c) The number of sofa sets sold in the year 2003 was P% less than the number sold in the year 2002. Calculate the value of P given that the amount received from the sales in the year was equal. (3 marks)

$$\frac{3240000}{16000}$$
$$= 202.5 \text{ sets}$$
$$216 - 202.5 = 13.5 \text{ sets}$$

$$\frac{13.5}{216} \times 100$$
$$= 6.25\%.$$

23) The ratio of Juma's and Akinyi's earnings was 5: 3. Juma's earnings rose to Ksh. 8400 after an increase of 12%.

(a) Calculate the percentage increase in Akinyi's earnings given that the sum of their earnings was Ksh. 14 100 (6 marks)

$$\text{J: A}$$
$$5: 3$$
$$\text{Juma earnings} = \text{sh. } 8400$$
$$112\% = 8400$$
$$\therefore 100$$
$$= \frac{100 \times 8400}{112}$$
$$= \text{sh. } 7500$$
$$\text{Tota ratio of the earnings;}$$

$$= 5 + 3 = 8$$
$$\text{Ratio } 5 = 7500$$
$$\therefore \text{ratio } 8$$
$$= \frac{8 \times 7500}{5}$$
$$= \text{sh. } 12000$$
$$\text{Akinyi earnings;}$$
$$= 12000 - 7500$$
$$= \text{sh. } 4500$$

$$\text{New earnings;}$$
$$= 14100 - 8400$$
$$= \text{sh. } 5700$$
$$\text{Increase} = 5700 - 4500$$
$$= \text{sh. } 1200$$
$$\% \text{ increase} = \frac{1200}{4500} \times 100$$
$$= 26\frac{2}{3}\%.$$

(b) Juma and Akinyi contributed all the new earnings to buy maize at Ksh. 1175 per bag. The maize was then sold at ksh. 1762.50 per bag. The two shared all the money from the sales of the maize in the ratio of their contributions. Calculate the amount that Akinyi got. (4 marks)

$\text{sh. } 1175 = 1 \text{ bag};$

$\therefore \text{sh. } 14100$

$= \frac{14100 \times 1}{1175}$

$= 12 \text{ bags}$

$1 \text{ bag} = \text{sh. } 1762.50$

$\therefore 12 \text{ bags}$

$= \frac{12 \times 1762.50}{1}$

$= \text{sh. } 21150$

$\text{Ratio between Akinyi: Juma};$

$= 5700 : 8400$

$= 19 : 28$

$\text{Total ratio} = 47$

$\text{Ratio } 47 = 21150$

$\therefore \text{Ratio } 19$

$= \frac{19 \times 21150}{47}$

$= \text{sh. } 8550.$

24) A solution whose volume is 80 litres is made up of 40% of water and 60% of alcohol. When x litres of water is added, the percentage of alcohol drops to 40%.

(a) Find the value of x

$\text{Water};$

$= \frac{40}{100} \times 80$

$= 32 \text{ litres}$

$\text{Alcohol} = 80 - 32$

$= 48 \text{ litres}$

$\frac{32 + x}{48} = \frac{60}{40}$

$1280 + 40x = 2880$

$40x = 1600$

$x = \frac{1600}{40}$

$= 40 \text{ litres}.$

(b) Thirty litres of water is added to the new solution. Calculate the percentage of alcohol in the resulting solution

$30 \text{ litres of water is added};$

$\text{New solution};$

$= 80 + 40 + 30$

$= 150 \text{ litres}$

$\text{Water} = 32 + 40 + 30$

$= 102 \text{ litres}$

$\text{Alcohol} = 150 - 102$

$= 48 \text{ litres}$

$\text{Percentage of alcohol};$

$= \frac{48}{150} \times 100$

$= 32\%.$

(c) If 5 litres of the solution in (b) above are added to 2 litres of the original solution, calculate in the simplest form, the ratio of water to that of alcohol in the resulting solution.

**New water;**

$$= \frac{68}{100} \times 5$$

$$= 3.4 \text{ litres}$$

$$\text{Original} = \frac{40}{100} \times 2$$

$$= 0.8 \text{ litres}$$

**Total volume;**

$$= 3.4 + 0.8$$

$$= 4.2 \text{ litres}$$

$$\text{Alcohol} = 1.6 \text{ litres}$$

$$\left(2 \times \frac{60}{100}\right) = 1.2 \text{ litres}$$

**Total;**

$$1.6 + 1.2 = 2.8 \text{ litres}$$

**Ratio;**

$$= 4.2 : 2.8$$

$$= \frac{4.2}{2.8}$$

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

$$= 3 : 2.$$