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Semester: Autumn 2026

ALLAMA IQBAL OPEN UNIVERSITY

Department of Mathematics

Course: Mathematics-I (247)

Programme / Level: Matric

Semester: Autumn, 2026

Assignment No. 1 (Units 1 to 5)

Total Marks: 100 | Pass Marks: 40

SOLVED ASSIGNMENT GUIDE — For Study & Reference

Note: This guide is for study and reference only. Students are advised to understand the methods shown and to write their assignments in their own words; copying verbatim is discouraged and the university's plagiarism policy applies to submitted work.

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Notes on the Printed Booklet

This booklet (Course: Mathematics-I (247), Level: Matric, Semester: Autumn, 2026, Department of Mathematics) contains Assignments No. 1 and No. 2 only, each of 100 total marks with 40 pass marks and five questions of 20 marks each; Assignment No. 1 covers Units 1 to 5 and Assignment No. 2 covers Units 6 to 9. Three printing points in Assignment No. 1 are handled transparently in this guide. In Question 1(a) the premium rate is printed as 'Rs. 4.50%', where 'Rs.' before a percentage rate is out of place; the rate is read as 4.50 per cent per year. In Question 2(a) the printed sentence is missing its verb ('XYZ Bank Rs. 8034 on its loan...'); it is read as the bank having earned Rs 8,034 as compound markup, a reading confirmed because it yields an exact principal of Rs 65,000, as explained in the answer. In Question 3(b) the price is printed 'for

R. 40 each', read as Rs. 40 each. In Question 4(a) the guide applies the fixed-share rule taught in the Matric course for the exercise as printed and expressly notes that a real estate must be settled with qualified scholars and legal advice. All numerical answers in this guide were worked and cross-checked by computer.

Question 1

Question 1 (20 marks): (a) The price of a car is Rs. 12,50,000, whereas the rate of premium is Rs. 4.50% for a tenure of 5 years. Calculate the total amount paid as insurance while depreciation is 10% yearly. (b) Jamila and Alia enter into a partnership, and their shares are in the ratio 1/2 : 1/3. After 4 months, Jamila withdraws half of her capital, and after 8 months more, a profit of Rs. 500 is divided. What is Jamila's share of profit?

Introduction

This question brings together two of the most useful ideas in commercial arithmetic: percentage applied to a value that itself changes from year to year, and the sharing of profit in a partnership in proportion to capital multiplied by time. In part (a) the car loses 10 per cent of its value every year, a process called depreciation, and the insurance premium of 4.50 per cent is charged each year on the value of the car at that time, not again and again on the original price. In part (b) the two partners do not keep the same amount of money in the business for the whole period, because Jamila withdraws half of her capital part of the way through. Profit in a partnership is therefore never divided simply in the ratio of the starting capitals whenever a capital changes during the year; it is divided in the ratio of capital multiplied by the number of months for which that capital actually remained in the business. Keeping these two principles clearly in mind is the

whole secret of the question, and each part below states its principle first, applies it step by step in a table, checks the answer in a second way, and only then draws the final conclusion.

Part (a): The Idea of Depreciation

Depreciation means a fall in value with the passage of time. When an asset depreciates at 10 per cent yearly on the reducing-balance method, which is the method used throughout the Matric course, each year the asset loses 10 per cent of its value at the beginning of that year, so it retains 90 per cent, that is 0.90, of that beginning value. The value at the start of the next year is therefore the old value multiplied by 0.90. After one year the car worth Rs 12,50,000 is worth 12,50,000 x 0.90 = Rs 11,25,000; after two years it is worth 11,25,000 x 0.90 = Rs 10,12,500, and so on. The amounts of depreciation themselves, Rs 1,25,000 in the first year, Rs 1,12,500 in the second year and smaller amounts afterwards, also fall every year, because 10 per cent is always being taken of a smaller and smaller base. This is exactly why the premium falls too: the insurance company is insuring a less valuable car each year, so 4.50 per cent of the current value is a smaller sum of money, even though the rate itself never changes.

Part (a): Working, Year by Year

The premium for any year is found from the ordinary percentage formula: premium = (rate / 100) x value at the beginning of the year = 0.045 x value. For the first year this gives 0.045 x 12,50,000 = Rs 56,250. For the second year it gives 0.045 x 11,25,000 = Rs 50,625. For the third year it gives 0.045 x 10,12,500 = Rs 45,562.50. For the fourth year the value is 9,11,250, so the premium is 0.045 x 9,11,250 = Rs 41,006.25. For the fifth year the value is 9,11,250 x 0.90 = Rs 8,20,125, so the premium is 0.045 x 8,20,125 = Rs 36,905.625, that is Rs 36,905.63 to the nearest paisa. Adding the five premiums, 56,250 + 50,625 + 45,562.50 + 41,006.25 +

36,905.625, gives a total of Rs 2,30,349.375, that is about Rs 2,30,349.38 paid as insurance over the five years. The table below sets out the whole schedule in one view, and the bar chart after it shows how the premium shrinks year by year as the insured value shrinks.

Year	Value at start of year (Rs)	Premium at 4.50% (Rs)	Value at end of year (Rs)
1	12,50,000	56,250.00	11,25,000
2	11,25,000	50,625.00	10,12,500
3	10,12,500	45,562.50	9,11,250
4	9,11,250	41,006.25	8,20,125
5	8,20,125	36,905.63	7,38,112.50
Total	-	2,30,349.38	-

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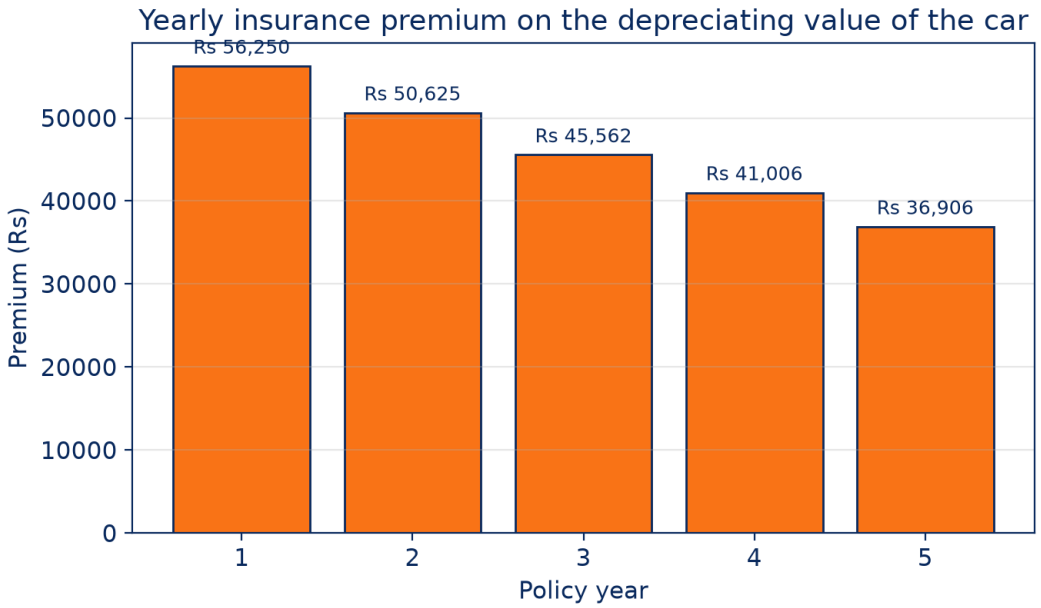


Figure 1: The yearly premium falls as the car's insured value depreciates by 10% a year.

A quick check protects against the most common mistake in this part. If a student wrongly charged the premium on the original price every year, the answer would be 5 x 56,250 = Rs 2,81,250, which is larger than the answer obtained here, as it should be, because depreciation must reduce the charge. A second check uses the formula for a geometric series: the premiums themselves form a geometric progression with first term 56,250 and common ratio 0.90, so their sum is 56,250 x (1 - 0.90^5) / (1 - 0.90) = 56,250 x (1 - 0.59049) / 0.10 = 56,250 x 4.0951 = Rs 2,30,349.375, exactly the figure obtained by adding the table row by row. Two independent methods giving the same total confirm the working. One printing point should be noted honestly: the booklet writes the rate as 'Rs. 4.50%', where the word 'Rs.' before a percentage rate is out of place; the rate is read throughout this answer as 4.50 per cent per year, which is the only reading that makes mathematical sense.

Part (b): Partnership and Capital Multiplied by Time

In part (b) the capitals of Jamila and Alia are in the ratio 1/2 : 1/3. Fractions are removed by multiplying both sides by 6, the least common multiple of 2 and 3, which gives the simple ratio 3 : 2. We may therefore represent Jamila's capital by 3 units and Alia's capital by 2 units; the actual rupee size of a unit does not matter, because only the proportion affects the division of profit. For the first 4 months Jamila's full 3 units are in the business, contributing 3 x 4 = 12 unit-months. She then withdraws half of her capital, leaving 1.5 units, and this reduced capital stays in the business for the remaining 8 months, contributing 1.5 x 8 = 12 unit-months. Jamila's total is therefore 12 + 12 = 24 unit-months. Alia never changes her capital, so she contributes 2 units for the whole 12 months, that is 2 x 12 = 24 unit-months. The effective ratio for dividing the profit is therefore 24 : 24, or simply 1 : 1: despite starting with the larger capital, Jamila's withdrawal

exactly cancels her early advantage, because for two-thirds of the year she had only half as much money at work, and half of 3 units is 1.5 units working for twice as long as the full 3 units did.

Partner	Capital (units)	First 4 months (unit-months)	Next 8 months (unit-months)	Total (unit-months)
Jamila	3, then 1.5 after withdrawal	3 x 4 = 12	1.5 x 8 = 12	24
Alia	2 throughout	2 x 4 = 8	2 x 8 = 16	24

Since the profit of Rs 500 is divided in the ratio 1 : 1, each partner receives exactly half of it, and Jamila's share is Rs 500 x 24 / (24 + 24) = Rs 250. It is worth pausing on why the naive answers are wrong, because examiners set this question precisely to test them. Dividing in the starting ratio 3 : 2 would give Jamila Rs 300, but that ignores her withdrawal completely. Giving her less than Alia because she withdrew would also be wrong, because for the first four months her capital was one and a half times Alia's, and that early period counts just as much as the later one. The capital-times-time rule weighs every rupee by every month it was actually employed, and it is the same rule used in real partnership accounts whenever a partner joins, leaves, or adds or withdraws capital in the middle of a year. If the amounts had been given in rupees instead of as a ratio, the identical method would apply: multiply each partner's rupees by the months for which they stayed invested, in each separate stretch, and divide the profit in the ratio of those products.

Conclusion

Both parts of the question reward the same habit: never apply a percentage or a ratio to a figure until you have asked what that figure actually is at the relevant moment. In part (a), applying the

4.50 per cent premium to the depreciating value, year by year, gives a total insurance payment of Rs 2,30,349.38 (exactly Rs 2,30,349.375) over the five years, verified both by direct addition and by the geometric-series formula. In part (b), reducing the capital ratio 1/2 : 1/3 to 3 : 2 and then weighting each capital by the months it remained invested gives equal effective contributions of 24 unit-months each, so Jamila's share of the Rs 500 profit is Rs 250, exactly one half. These two answers, Rs 2,30,349.38 and Rs 250, are the required results, and the tables above show every step by which they are reached, so that the method can be reused on any similar problem with different numbers.

Question 2

Question 2 (20 marks): (a) XYZ Bank Rs. 8034 on its loan at 6% compound markup in 2 years. What amount did it lend? (b) An army formation of 900 men has a food stock for 30 days. Later on, 150 army men leave the formation. For how many days will the same food be sufficient for the remaining army men?

Introduction

Part (a) of this question is a reverse compound-interest problem, and part (b) is a problem in inverse proportion. Both look short, yet both are frequently answered wrongly because the student works forwards when the question is really asking him to work backwards, or treats an inverse relationship as though it were a direct one. In part (a) we are told the compound markup, the interest itself, and we must recover the principal that produced it; the booklet's sentence, as printed, is missing its verb, and a transparency note in this answer explains openly how it is being read, and why that reading is certainly the intended one: the numbers work out to an exact, round principal on that reading and on no other. In part (b) the total stock of food is fixed, so the

number of men and the number of days are linked inversely: fewer mouths to feed means the same stock lasts longer, in exact inverse ratio. The two parts are solved below with their formulas stated first, the substitution shown in full, and a forwards check in each case, so that the reader can see the answer prove itself.

Transparency note on the printed wording of part (a): the booklet prints the sentence without a verb - 'XYZ Bank Rs. 8034 on its loan at 6% compound markup in 2 years.' The missing verb is understood here as 'earned' (equivalently 'received as markup'), so that Rs 8,034 is the compound markup earned in the two years. This reading is confirmed by the arithmetic itself: at 6 per cent for 2 years the markup factor is (1.06)^2 - 1 = 0.1236, and 8,034 / 0.1236 = 65,000 exactly, a perfectly round principal. If Rs 8,034 were instead read as the total amount repaid, the principal would be 8,034 / 1.1236 = about Rs 7,150.03, an untidy figure that no textbook would set. The question is therefore solved on the 'markup earned' reading.

Part (a): Recovering the Principal from the Compound Markup

For compound markup the amount after n years on a principal P at rate r per cent per year is A = P (1 + r/100)^n, and the markup earned is the amount minus the principal, I = P [(1 + r/100)^n - 1]. Here the rate is 6 per cent and the time is 2 years, so the yearly growth factor is 1.06 and the two-year growth factor is 1.06 x 1.06 = 1.1236. The markup factor is therefore 1.1236 - 1 = 0.1236, which means that whatever sum the bank lent grew by 12.36 per cent of itself over the two years. Since that growth is given as Rs 8,034, we have 0.1236 x P = 8,034, and dividing, P = 8,034 / 0.1236 = Rs 65,000. The bank therefore lent Rs 65,000. Notice what compound markup does inside the two years: in the first year the loan earns 6 per cent of 65,000, which is Rs 3,900, bringing the balance to Rs 68,900; in the second year it earns 6 per cent not of the original 65,000 but of 68,900, which is Rs 4,134, bringing the final amount to Rs 73,034. The two

markups add to 3,900 + 4,134 = Rs 8,034, exactly the given figure, which verifies the principal forwards as well as backwards.

The comparison with simple interest shows why the compound condition matters and why the question specifies it. Had the same Rs 65,000 been lent at 6 per cent simple interest for 2 years, the interest would have been 65,000 x 0.06 x 2 = Rs 7,800, which is Rs 234 less than the compound markup. That difference of Rs 234 is exactly the interest earned in the second year on the first year's interest, 6 per cent of Rs 3,900, and it is the defining feature of compounding: interest itself begins to earn interest. Working in the opposite direction is also a useful student check: if someone guessed that the principal had been Rs 60,000, the markup would be 60,000 x 0.1236 = Rs 7,416, too small; if Rs 70,000, the markup would be Rs 8,652, too large; the given Rs 8,034 falls between them and corresponds, as shown, to exactly Rs 65,000. Problems of this 'find the principal' type appear in banking, in provident-fund and in hire-purchase calculations whenever the accumulated charge is known and the original sum advanced must be recovered for the accounts.

Part (b): Men and Days in Inverse Proportion

The stock of food can be measured in 'man-days': the number of men multiplied by the number of days the stock will feed them, assuming every man eats the same ration each day. A stock that feeds 900 men for 30 days contains 900 x 30 = 27,000 man-days of food. When 150 men leave the formation, 900 - 150 = 750 men remain, and the stock itself has not changed, so the same 27,000 man-days must now be shared among 750 men. The number of days is therefore 27,000 / 750 = 36 days. The same result comes from the inverse-proportion formula at once: days vary inversely as men, so the new number of days = old days x (old number of men / new number of men) = 30 x 900 / 750 = 30 x 1.2 = 36 days. The answer, 36 days, is greater than 30 days, which

is the essential reasonableness check: with fewer men eating, the food must last longer, never fewer days, and any method that produces an answer below 30, such as the direct-proportion calculation 30 x 750 / 900 = 25 days, has the proportion the wrong way round and can be rejected on sight.

Situation	Number of men	Days the stock lasts	Man-days of food (men x days)
As first stated	900	30	900 x 30 = 27,000
After 150 men leave	750	36	750 x 36 = 27,000

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It helps to see the general pattern behind this single example, because questions of this family are set with wells, pumps, workers, machines and hostel messes as often as with soldiers. Whenever a fixed quantity of work or of stock is shared among a changing number of consumers or workers, the product of the two factors stays constant, and the unknown is found by keeping that product unchanged. If instead 300 men had left, 600 men would remain and the stock would last 27,000 / 600 = 45 days; if 150 extra men had joined, 1,050 men would be fed for 27,000 / 1,050 = about 25.7 days. Each case obeys the same rule, and the table format above, with the man-days column forced to be equal in both rows, is a reliable layout for any of them, because it makes a wrong direction of proportion immediately visible: the third column must match, and if it does not, the working is wrong before any final figure is even written down.

Conclusion

Part (a) is solved by reversing the compound-amount formula: because a principal at 6 per cent compound markup grows by the factor 1.1236 in two years, a markup of Rs 8,034 corresponds to

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a principal of Rs 65,000, and the forwards year-by-year check, Rs 3,900 of markup in the first year and Rs 4,134 in the second year totalling exactly Rs 8,034, proves the result. Part (b) is solved by conserving man-days: the stock holds 27,000 man-days, so among the 750 men who remain after 150 leave, it lasts 27,000 / 750 = 36 days. The two answers are therefore Rs 65,000 lent, and 36 days of food. The wider lesson of the question is to diagnose the type before calculating: a 'work backwards from the interest' problem needs division by the growth factor, and a 'fixed stock, changing consumers' problem needs inverse, not direct, proportion.

Question 3

Question 3 (20 marks): (a) The total taxable income of a person is Rs. 4,30,000. If he is given a rebate of Rs. 3000 on the tax chargeable, then work out the amount he has to pay as income tax @ 4.5% (b) A shopkeeper bought 100 hockey balls for R. 40 each. He sells 20 of them at a profit of 5%. At what profit percent must he sell the remaining so as to get a profit 20% on the whole?

Introduction

This question deals with percentage in two everyday settings: income tax in part (a), where a percentage charge is computed on a taxable income and then reduced by a fixed rebate, and retail profit in part (b), where an overall profit target for a whole stock has to be achieved even though part of the stock has already been sold at a much smaller profit. The two parts test different skills. Part (a) is about order of operations: the rebate is a fixed sum of rupees taken off the tax after the tax has been calculated, not a reduction of the taxable income before the percentage is applied, and confusing those two orders gives a wrong answer. Part (b) is about working with totals rather than with individual prices: because the first twenty balls have earned only 5 per cent while the whole transaction must earn 20 per cent, the remaining eighty balls must earn

more than 20 per cent to pull the average up, and the exact extra amount is found by comparing total cost, total target receipts, and the receipts already obtained. Both parts are worked below from totals, with checks, and the printed wording of part (b), which writes 'for R. 40 each' where 'Rs. 40' is plainly meant, is followed in that sense.

Part (a): Tax Chargeable, Then Rebate

The tax chargeable is found by applying the rate of 4.5 per cent to the total taxable income of Rs 4,30,000. Tax = (4.5 / 100) x 4,30,000 = 0.045 x 4,30,000 = Rs 19,350. From this chargeable tax the government allows the taxpayer a rebate of Rs 3,000, a fixed reduction of the bill itself, so the amount he actually has to pay is 19,350 - 3,000 = Rs 16,350. That is the answer to part (a): income tax payable is Rs 16,350. It is instructive to see what the effective rate becomes after the rebate: 16,350 / 4,30,000 = 0.0380, about 3.80 per cent of the income, so the rebate has lowered the effective burden from 4.5 per cent to roughly 3.8 per cent. If, by mistake, the rebate were subtracted from the income first, the calculation would be 0.045 x (4,30,000 - 3,000) = 0.045 x 4,27,000 = Rs 19,215, a figure only Rs 135 less than the unrebated tax, because a rebate taken off the income is worth only the tax rate times the rebate, whereas a rebate taken off the tax is worth its full face value of Rs 3,000. The wording of the question, 'a rebate of Rs. 3000 on the tax chargeable', settles the matter: the rebate is on the tax, so it is deducted in full after the percentage has been worked out, exactly as a tax credit operates in a real assessment.

Part (b): Setting Up the Totals

The shopkeeper buys 100 hockey balls at Rs 40 each, so his total cost price is 100 x 40 = Rs 4,000. He wants a profit of 20 per cent on the whole transaction, so his total selling receipts must be cost plus 20 per cent of cost, that is 4,000 x 1.20 = Rs 4,800, giving a total profit of Rs 800.

He has already sold 20 balls at a profit of 5 per cent. Those 20 balls cost 20 x 40 = Rs 800, and selling them at 5 per cent profit brought him 800 x 1.05 = Rs 840, a profit of only Rs 40 on that batch. The remaining 80 balls cost 80 x 40 = Rs 3,200, and they must bring in the rest of the target receipts, namely 4,800 - 840 = Rs 3,960. The profit required on the remaining balls is therefore 3,960 - 3,200 = Rs 760, and as a percentage of their cost this is (760 / 3,200) x 100 = 23.75 per cent. He must sell the remaining eighty balls at a profit of 23.75 per cent, which means at a selling price of 40 x 1.2375 = Rs 49.50 per ball.

Batch	Balls	Cost (Rs)	Profit rate	Receipts (Rs)	Profit (Rs)
First batch (already sold)	20	800	5%	840	40
Remaining batch (to be sold)	80	3,200	23.75%	3,960	760
Whole transaction	100	4,000	20% overall	4,800	800

The answer can be checked by the method of weighted averages, which also explains why the required rate had to exceed 20 per cent. The overall profit rate is the cost-weighted average of the rates on the two batches: the first batch carries weight 800 out of 4,000, that is one-fifth of the cost, and contributes 5 per cent, while the second batch carries four-fifths of the cost and contributes the unknown rate. For the average to be 20, we need (1/5)(5) + (4/5)(x) = 20, so 1 +

0.8x = 20 and x = 19 / 0.8 = 23.75, exactly the rate found from the totals. Intuitively, the first batch fell 15 percentage points short of the target on one-fifth of the stock, creating a shortfall that the remaining four-fifths must make good; spread over that larger base, the catch-up adds 3.75 points to the target, taking the second batch to 23.75 per cent. A common error is to answer 35 per cent by simply adding the shortfall of 15 points to 20; that ignores the different sizes of the two batches and, if checked in rupees, would overshoot the target badly, producing total receipts of 840 + 3,200 x 1.35 = Rs 5,160 instead of Rs 4,800. Working in total rupees first, as in the table, is the safest habit for every 'profit on the whole' problem.

Conclusion

In part (a) the tax chargeable at 4.5 per cent on Rs 4,30,000 is Rs 19,350, and after the rebate of Rs 3,000 on the tax itself, the amount the person has to pay is Rs 16,350, an effective rate of about 3.80 per cent. In part (b) the whole stock cost Rs 4,000 and must realise Rs 4,800 for a 20 per cent overall profit; the first twenty balls have realised only Rs 840, so the remaining eighty, costing Rs 3,200, must realise Rs 3,960, a profit of Rs 760, which is 23.75 per cent, at Rs 49.50 per ball. Both answers have been verified by a second route, the effective-rate check for the tax and the weighted-average check for the profit, and together they illustrate the central rule of this unit: in percentage problems, always be clear about the base to which each percentage applies, and when a result 'on the whole' is required, work with the totals of rupees before converting back into a percentage.

Question 4

Question 4 (20 marks): (a) Najeeb left a wealth amounting to Rs. 4,00,000. He left behind a widow, while they did not have any children. Find the share of Najeeb's widow. (b) In a certain

year, Javed puts Rs. 600 in a private bank at the end of March and Rs. 400 in the same bank at the end of June. The bank offers 3% per annum simple interest rate. Find the total amount Javed receives from the bank at the end of December in that year?

Introduction

Part (a) of this question is the inheritance item of the commercial-arithmetic unit, and part (b) is a simple-interest problem in which two deposits are made at different times during the same year, so that each deposit earns interest for a different number of months. Part (b) is purely computational and is treated in full below. Part (a) needs a short, careful statement of approach. The Matric mathematics course sets this as an arithmetic exercise applying the fixed-share rule taught in the textbook for a widow when the deceased leaves no children, namely a share of one-fourth of the estate. This guide applies that textbook rule, as the question intends, and shows the arithmetic. It does not present itself as a religious ruling for any real family: in an actual estate there may be debts, funeral expenses, a will, parents or other heirs, and questions of law, and the distribution of a real estate must be settled with qualified scholars and proper legal advice. Within the exercise as printed, however, only the widow is named, no children exist, no other heir or deduction is mentioned, and the single thing asked is the widow's share, which the rule fixes at one-fourth.

Part (a): The Widow's Share as Set in the Exercise

The estate left by Najeeb is Rs 4,00,000. Applying the fixed share of one-fourth that the course assigns to a widow where the deceased has no child, the widow's share is (1/4) x 4,00,000 = Rs 1,00,000. The question asks only for this share, and Rs 1,00,000 is its answer. It is important for the student's understanding to notice why the absence of children is mentioned at all: the

textbook rule distinguishes the two cases, giving the widow a smaller fixed fraction, one-eighth, when the deceased leaves children, and one-fourth when he does not, because when children exist they take the major part of what remains. The printed question deliberately supplies the fact 'they did not have any children' so that the student selects the one-fourth rule rather than the one-eighth rule; without that fact the problem would be ambiguous. The remaining Rs 3,00,000 of the estate is simply not asked about in the exercise, and this guide makes no claim about how it would be distributed in a real case, since that would depend on the full list of heirs and on circumstances the question does not give. Students should reproduce the exercise exactly as set, one-fourth of Rs 4,00,000 equals Rs 1,00,000, and, if they ever face the situation in real life rather than in an examination, take the complete facts to qualified scholars and a lawyer instead of relying on a textbook example.

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Part (b): Simple Interest on Two Deposits for Different Periods

Simple interest is computed by the formula I = P x R x T / 100, where P is the principal, R the rate per cent per annum, and T the time in years. Because the two deposits are made on different dates, they earn interest for different times, and each must be treated separately; adding the deposits together first and giving the whole Rs 1,000 a single period of time is the error this question is designed to catch. The first deposit of Rs 600 is made at the end of March. From the end of March to the end of December is nine months, April through December, so T = 9/12 of a year, and the interest is 600 x 3 x (9/12) / 100 = 600 x 0.03 x 0.75 = Rs 13.50. The second deposit of Rs 400 is made at the end of June. From the end of June to the end of December is six months, July through December, so T = 6/12 of a year, and the interest is 400 x 3 x (6/12) / 100 = 400 x 0.03 x 0.50 = Rs 6.00. The total interest earned is 13.50 + 6.00 = Rs 19.50, and since both

principals remain Javed's own money, the total amount he receives from the bank at the end of December is 600 + 400 + 19.50 = Rs 1,019.50.

Deposit	Date deposited	Months to end of December	Interest at 3% p.a. simple (Rs)
Rs 600	End of March	9	600 x 3 x 9 / (100 x 12) = 13.50
Rs 400	End of June	6	400 x 3 x 6 / (100 x 12) = 6.00
Total Rs 1,000	-	-	19.50; amount received = Rs 1,019.50

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Two checks confirm the working and reveal the structure of the problem. First, the average-period check: the weighted average time for the Rs 1,000 is (600 x 9 + 400 x 6) / 1,000 = (5,400 + 2,400) / 1,000 = 7.8 months, and interest on Rs 1,000 at 3 per cent for 7.8 months is 1,000 x 0.03 x 7.8/12 = Rs 19.50, the same total, as it must be for simple interest, where interest is exactly proportional to both principal and time. Second, the reasonableness check: had the whole Rs 1,000 been deposited for a full year it would have earned Rs 30, and had none of it been in the bank for more than nine months the interest must be less than Rs 30, which Rs 19.50 is; an answer larger than Rs 30 would be impossible on these dates. Students should also note the convention the question uses, that a deposit 'at the end of' a month earns nothing for that month itself and begins earning from the next month, and that 'at the end of December' both deposits are

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withdrawn together with their interest. Private banks and savings schemes in practice may credit interest on monthly minimum balances or on daily products, but the examination method is the month-counting method used here.

Conclusion

In part (a), applying the textbook fixed-share rule for a widow where there are no children, one-fourth of the estate, to Najeeb's wealth of Rs 4,00,000 gives the widow's share as Rs 1,00,000, with the express caution that a real estate, with its possible debts and other heirs, belongs with qualified scholars and legal advice and not with an arithmetic exercise. In part (b), the two deposits earn interest for different periods, nine months for the Rs 600 deposited at the end of March giving Rs 13.50, and six months for the Rs 400 deposited at the end of June giving Rs 6.00, so Javed receives his Rs 1,000 of principal plus Rs 19.50 of interest, a total of Rs 1,019.50 at the end of December. The common thread is again precision about the given facts: in the first part, the stated absence of children selects the correct fraction, and in the second part, the stated deposit dates fix the two different times that make the interest calculation come out right.

Question 5

Question 5 (20 marks): (a) A lady worker works a six-day week. She starts work at 7.00 AM and finishes at 4 PM. She has 15 minutes break in the morning and 45 minutes break in the afternoon. How long does she actually work in a week, and how much is she paid, if the rate of payment is Rs. 40 per hour? (b) The marked price of a book is Rs. 480. The shopkeeper offers a discount of 10% and still gains 8%. Find the price at which the shopkeeper purchased it.

Introduction

The final question of the assignment joins a wages problem, part (a), to a problem about the chain from cost price to marked price to selling price, part (b). In part (a) the trap is that the time a worker is present at the workplace is not the time she actually works: unpaid breaks must be subtracted before the hours are multiplied by the number of working days and by the hourly rate, and clock arithmetic from 7.00 AM to 4 PM must be handled correctly across noon. In part (b) the trap is that the discount and the gain are percentages on two different bases: the discount of 10 per cent is taken on the marked price of Rs 480, while the gain of 8 per cent is measured on the shopkeeper's unknown cost price. The selling price is the bridge between the two, because it is what remains of the marked price after the discount, and it is also the cost price increased by the gain. Finding the selling price first, and only then working back to the cost price, is the clean method, and it is the method used below, with forward checks in both parts so that every figure can be seen to fit the wording of the question.

Part (a): Actual Working Time and Weekly Wages

From 7.00 AM to 4.00 PM is nine hours of attendance: five hours from 7.00 AM to 12 noon and four hours from noon to 4.00 PM. Against these nine hours the worker takes two breaks, 15 minutes in the morning and 45 minutes in the afternoon, totalling 15 + 45 = 60 minutes, exactly one hour, during which she is not working and, on the terms of the question, is not paid. Her actual working time per day is therefore 9 - 1 = 8 hours. She works a six-day week, so her actual working time in a week is 8 x 6 = 48 hours. At the rate of Rs 40 per hour, her weekly pay is 48 x 40 = Rs 1,920. The two answers to part (a) are therefore 48 hours of actual work in the week, and Rs 1,920 in weekly wages. The calculation may also be done day by day, 8 hours x Rs 40 = Rs 320 per day, and 320 x 6 = Rs 1,920 for the week, which agrees, as it must, and gives the useful intermediate figure of her daily wage.

It is worth examining the errors that this part is built to expose, because each corresponds to a real dispute that can arise over a wage slip. If the breaks were ignored, the week would be counted as 9 x 6 = 54 hours and the pay as Rs 2,160, overpaying by Rs 240, which is exactly the value of the six unpaid break-hours in the week, 6 x 40. If, at the other extreme, a student converted the span 7 AM to 4 PM wrongly as 4 - 7 hours or as 11 hours by counting both endpoints, every later figure would be corrupted at the source. The safe routine for clock problems is to count forwards in pieces, home to noon and noon onwards, convert everything to a single unit, here hours, subtract all non working time, and only then multiply by days and by rate. The same routine handles factory shifts, overtime problems and examination questions about labourers and machines, and in all of them the phrase to watch is 'actually work', which is the question's own signal that attendance time and working time are not the same thing and that the breaks are given precisely so that they will be deducted.

Part (b): Marked Price, Discount, Selling Price and Cost Price

The marked price of the book is Rs 480. The shopkeeper allows a discount of 10 per cent on the marked price, so the discount is (10/100) x 480 = Rs 48, and the selling price actually received is 480 - 48 = Rs 432. This selling price still gives him a gain of 8 per cent on the price at which he purchased the book, his cost price. If the cost price is denoted by C, then selling at a gain of 8 per cent means 432 = C x (1 + 8/100) = 1.08 C, so C = 432 / 1.08 = Rs 400. The shopkeeper purchased the book for Rs 400. The forward check is immediate: 8 per cent gain on Rs 400 is Rs 32, and 400 + 32 = Rs 432, which is exactly the selling price obtained after the discount, while the discount check also closes, 432 being exactly 90 per cent of the marked price of Rs 480. The three quantities therefore sit in a consistent chain: cost price Rs 400, marked price Rs 480, selling

price Rs 432, and the differences between them are the gain of Rs 32 over cost and the discount of Rs 48 off the marked price.

Quantity	Value (Rs)	How obtained
Cost price (purchase price)	400	432 / 1.08
Marked price	480	Given in the question
Discount at 10% of marked price	48	0.10 x 480
Selling price	432	480 - 48, also 400 x 1.08
Gain at 8% of cost price	32	432 - 400

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The general method deserves stating because this exact pattern, marked price with a discount and a gain, is one of the most repeated in the whole course. Always pass through the selling price, and always ask of each percentage, 'per cent of what?' The discount percentage always belongs to the marked price, for it is the price tag that is reduced; the gain or loss percentage always belongs to the cost price, for profit is measured on the money the trader laid out. Dividing by 1.08, rather than subtracting 8 per cent of Rs 432, is the step students most often get wrong: subtracting 8 per cent of the selling price would give 432 - 34.56 = Rs 397.44, which when increased by 8 per cent gives only Rs 429.24, not Rs 432, so that method fails its own check. The division method never fails, because it exactly reverses the multiplication by which the selling price was built up from the cost price. Traders mark goods above cost precisely so that a discount can be offered while a profit remains, and this example shows the arithmetic of that practice in

miniature: a 20 per cent mark-up from Rs 400 to Rs 480 leaves room for a 10 per cent discount and still preserves an 8 per cent gain.

Conclusion

In part (a), the worker attends for nine hours a day but, after deducting her 15-minute morning break and 45-minute afternoon break, actually works eight hours a day; over a six-day week that is 48 hours, and at Rs 40 per hour she is paid Rs 1,920 for the week, or Rs 320 per working day. In part (b), the discount of 10 per cent on the marked price of Rs 480 fixes the selling price at Rs 432, and since that price carries an 8 per cent gain on cost, the cost price is 432 / 1.08 = Rs 400, the price at which the shopkeeper purchased the book. Both parts turn on identifying the correct base and the correct quantity before multiplying: paid time rather than attendance time in the wages problem, and the marked price for discount but the cost price for gain in the book problem. With those identifications made, each calculation is short, and each answer, 48 hours and Rs 1,920, and a purchase price of Rs 400, checks forwards perfectly.

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