Discount (True and Banker's) 21

INTRODUCTION

Suppose, a man buys a pen at a credit of one year for ₹105 at 5% simple interest. If the money is to be paid immediately, he shall give ₹100. ₹100 is the *present value* or *present worth* of ₹105 due in 1 year. Hence, the sum due (₹105) is called the *amount* and the reduction made in consideration of making the immediate payment is called *true discount*.

Present Value

The *present value* or *present worth* of a sum of money due at the end of a given time is that sum which with its interest for the given time at the given rate will amount to the sum due.

True Discount (T.D.)

The *true discount* is the difference between the sum due at the end of a given time and its present worth. Thus, T.D. = Amount (A) − present worth (P.W.)
In the above case, T.D. = ₹(105 − 100) = ₹5.

Note:

1. Clearly, T.D. is the Interest on P.W. and
$$A = P.W. + T.D.$$
2. Interest is reckoned on P.W. and T.D. is reckoned on amount.

Banker's Discount

Suppose, businessman A purchases goods worth ₹10000 from businessman B at a credit of 3 months. Thus, B prepares a bill, called the *bill of exchange*. On receipt of the goods, A gives an agreement and signs the bill accepting that the money can be withdrawn from his account after 3 months of the date of the bill. Accordingly, A orders his bank to pay ₹10000 to B after 3 months.

Besides, 3 days grace period is also added to this date (named *nominally due date*) of expiry of 3 months to arrive at a date called *legally due date*. Thus, if April 4, 2004 is the nominally due date then April 7, 2004 will be legally due date. The amount of ₹10000 is called the *face value*.

Now, suppose, B needs the money of this bill earlier than April 7, say March 7. In such a case, B can approach the banker or broker to pay him the money against the bill. Obviously, in such a situation, the money paid by the banker will be less than the face value of the bill. Now, suppose, the bill is presented to the banker on March 7, 2004, then the banker will deduct the interest on the face value for the period March 7, 2004 to April 7, 2004 and this interest is called the *Banker's Discount* (B.D.) or *Commercial Discount*.

Thus, Banker's Discount is the simple interest on the face value for the period from the date on which the bill was discounted and the legally due date. The amount mentioned in the bill is called the *face value* of the bill. It may be noted that *banker's discount* is greater than the *true discount*, because while the true discount is the interest on the present worth, banker's discount is the interest on sum due.

The difference between the present worth and cash value of a bill is called the *banker's gain* (B.G.). Thus, the interest on the bill value (or the face value) is called the banker's discount (B.D) and the difference between the banker's discount and true discount (T.D.) is called banker's gain (B.G.)

We have the following results.

Banker's gain = Banker's discount − True discount

= Interest on sum due − Interest on present worth

= Interest on (sum due − present worth)

= Interest on true discount.

SOME BASIC FORMULAE

1. If rate = $R\%$ p.a. and time = T years, then

(i) P.W. = $\dfrac{100 \times A}{100 + R \times T} = \dfrac{100 \times \text{T.D.}}{R \times T}$

Illustration 1: Find the present worth of ₹8700 due in 3 years at 15% per annum at simple interest. Also, find the true discount.

Solution: P.W. = $\dfrac{100 \times A}{100 + R \times T} = \dfrac{100 \times 8700}{100 + 15 \times 3}$

$= \dfrac{100 \times 8700}{145}$ = ₹6000

T.D. = Amount − P.W. = 8700 − 6000 = ₹2700.

(ii) T.D. = $\dfrac{\text{P.W.} \times R \times T}{100} = \dfrac{A \times R \times T}{100 + R \times T}$

Illustration 2: Find the true discount and the sum for 15 months, hence whose present value at 8% is ₹1000.

Solution: T.D. = $\dfrac{\text{P.W.} \times R \times T}{100} = \dfrac{1000 \times 8 \times 15}{100 \times 12}$

$= $ ₹100.

Sum due = P.W. + T.D.

$= 1000 + 100 = $ ₹1100.

Illustration 3: Find the true discount reckoning 3% p.a. simple interest on ₹1802 due in 2 year's time.

Solution: T.D. = $\dfrac{A \times R \times T}{100 + R \times T} = \dfrac{1802 \times 3 \times 2}{100 + 3 \times 2}$ = ₹102.

(iii) Sum (A) = $\dfrac{\text{S.I.} \times \text{T.D.}}{\text{S.I.} - \text{T.D.}}$

Explanation

$\dfrac{\text{S.I.} \times \text{T.D.}}{\text{S.I.} - \text{T.D.}} = \dfrac{\left(A \times R \times \dfrac{T}{100}\right) \times \text{T.D.}}{\left(\text{T.D.} \times R \times \dfrac{T}{100}\right)} = A$

$\therefore \quad A = \dfrac{\text{S.I.} \times \text{T.D.}}{\text{S.I.} - \text{T.D.}}$

Illustration 4: The true discount on a certain sum of money due for 2 years, hence it is ₹1800. The simple interest on the same sum is ₹2232. Find the sum.

Solution: Sum (A) $= \dfrac{\text{S.I.} \times \text{T.D.}}{\text{S.I.} - \text{T.D.}} = \dfrac{2232 \times 1800}{2232 - 1800}$

$= \dfrac{2232 \times 1800}{432} = $ ₹9300.

(iv) S.I. − T.D. = S.I. on T.D.

Explanation

S.I. − T.D. = $\dfrac{A \times R \times T}{100} - \dfrac{\text{P.W.} \times R \times T}{100}$

$= (A - \text{P.W.}) \times \dfrac{R \times T}{100}$

$= \dfrac{\text{T.D.} \times R \times T}{100} = $ S.I. on T.D.

Illustration 5: The discount on a certain sum is due for 4 years, hence it is ₹100. But the interest on the same sum for the same period is ₹125. Find the sum and the interest rate.

Solution: We have,

S.I. on T.D. = S.I. − T.D.

$= 125 - 100 = $ ₹25.

$\therefore \quad$ Rate $(R) = \dfrac{25 \times 100}{100 \times 4} = \dfrac{25}{4} = 6\dfrac{1}{4}\%$

and, Sum $(A) = \dfrac{\text{S.I.} \times \text{T.D.}}{\text{S.I.} - \text{T.D.}} = \dfrac{125 \times 100}{125 - 100}$

$= $ ₹500.

(v) When the money is invested on compound interest,

$$\text{P.W.} = \dfrac{A}{\left(1 + \dfrac{R}{100}\right)^T}$$

Illustration 6: Find the present worth of a bill of ₹3380 due for 2 years at 4% compound interest. Also, calculate the T.D.

Solution: P.W. = $\dfrac{A}{\left(1 + \dfrac{R}{100}\right)^T} = \dfrac{3380}{\left(1 + \dfrac{4}{100}\right)^2}$

$= \dfrac{3380 \times 25 \times 25}{26 \times 26} = $ ₹3125.

T.D. = A − P.W.

$= 3380 - 3125 = $ ₹255.

2. B.D. = S.I. on the bill for unexpired time

3. B.G. = B.D. − T.D.

4. B.D. = T.D. + Interest on T.D.

5. Sum Due = $\dfrac{\text{B.D.} \times \text{T.D.}}{\text{B.D.} - \text{T.D.}}$

6. T.D. = $\sqrt{\text{P.W.} \times \text{B.G.}}$

7. T.D. = $\dfrac{\text{B.G.} \times 100}{\text{Rate} \times \text{Time}}$

8. T.D. = $\dfrac{\text{Amount} \times \text{Rate} \times \text{Time}}{100 + (\text{Rate} \times \text{Time})}$

9. B.D. = $\dfrac{\text{Amount} \times \text{Rate} \times \text{Time}}{100}$

10. Sum Due = $\dfrac{\text{B.D.} \times 100}{R \times T}$

11. Money paid by the banker = Amount − B.D.

Illustration 7: A bill is drawn for ₹5050 on June 12, 2004 for a 5 months credit period. It is discounted on September 3, at 5% per annum.

Find the:

(i) Banker's discount;

(ii) Money received by the holder of the bill; and

(iii) Banker's gain.

Solution: Amount = ₹5050.

Date of drawing = June 12, 2004 (for 5 months)

Date of maturing = Nov 15, 2004 (including 3 days grace)

Date of discounting = September 3, 2004.

Number of days from Sept 3. to Nov 15. =

Sept.   Oct.   Nov.

27   + 31 +15 = 73 days = $\dfrac{1}{5}$ year.

∴ (i) Banker's discount = $\dfrac{\text{Amount} \times \text{Rate} \times \text{Time}}{100}$

$= \dfrac{5050 \times 1 \times 5}{100 \times 5}$ = ₹50.50.

(ii) Amount received by the holder of the bill

= Amount − B.D.

= 5050 − 50.50 = ₹4999.50.

(iii) True discount on ₹5050

$= \dfrac{\text{Amount} \times \text{Rate} \times \text{Time}}{100 + (\text{Rate} \times \text{Time})}$

$= \dfrac{5050 + \dfrac{1}{5} \times 5}{100 + \dfrac{1}{5} \times 5}$ = ₹50

Banker's gain = B.D. − T.D. = ₹0.50.

Illustration 8: The banker's discount and the true discount on a certain sum of money due for 4 months are ₹48 and ₹45, respectively. Find the sum and the rate of interest.

Solution: Sum = $\dfrac{\text{B.D.} \times \text{T.D.}}{\text{B.D.} - \text{T.D.}} = \dfrac{48 \times 45}{48 - 45} = \dfrac{48 \times 45}{3}$

= ₹720.

Now, the banker's discount is simple interest on the sum due for 4 months.

Rate of interest = $\dfrac{100 \times 48 \times 3}{720 \times 1}$ = 20% p.a.

Illustration 9: Find the face value of a 3 months bill when the banker's discount at 3% per annum is ₹18.

Solution: B.D. = ₹18; Rate (R) = 3%,

Time (T) = $\dfrac{1}{4}$ years.

∴ Face value = $\dfrac{\text{B.D.} \times 100}{R \times T} = \dfrac{18 \times 100 \times 4}{3 \times 1}$ = ₹2400.

Illustration 10: The present worth of a bill due for sometime is ₹1500. Find the banker's discount on the bill, if the true discount is ₹75.

Solution: T.D. = $\sqrt{\text{P.W.} \times \text{B.G.}}$

⇒ 75 = $\sqrt{1500 \times \text{B.G.}}$

⇒ 75 × 75 = 1500 × B.G.

⇒ B.G. = $\dfrac{75 \times 75}{1500}$ = ₹$\dfrac{15}{4}$

or, ₹3.75.

B.D. = T.D. + B.G. = 75 + 3.75 = ₹78.75.

Illustration 11: The banker's gain on a bill due for 1 year at 12% per annum is ₹6. Find the true discount.

Solution: T.D. = $\dfrac{\text{B.G.} \times 100}{R \times T} = \dfrac{6 \times 100}{12 \times 1}$ = ₹50.

Illustration 12: If the true discount on a certain sum due for 6 months at 6% is ₹36, what is the banker's discount on the same sum for the same period and at the same rate?

Solution: B.D. = T.D. + Interest on T.D.

$= \text{T.D.} + \dfrac{\text{T.D.} \times R \times T}{100} = 36 + \dfrac{36 \times 6 \times 6}{100 \times 12}$

= 36 + 1.08 = ₹37.08.

1. The true discount on a bill of ₹1260 is due for 6 months at 10% per annum is:

   (a) ₹60 (b) ₹160
   (c) ₹80 (d) ₹260

2. If the discount on a certain sum in 2 years at a certain rate is ₹150 and the interest in 3 years is ₹240. Find the sum and the rate of interest.

   (a) ₹2400, $3\frac{1}{3}$% (b) ₹2400, $4\frac{1}{3}$%

   (c) ₹2200, $5\frac{1}{3}$% (d) None of these

3. If the true discount on ₹161 is due for 2 years and 6 months is ₹21, then find the rate of interest.

   (a) $2\frac{1}{2}$% (b) $4\frac{1}{2}$%
   (c) 5% (d) 6%

4. The present worth of ₹920 due at the end of 3 years at 5% simple interest per annum is:

   (a) ₹780 (b) ₹850
   (c) ₹800 (d) ₹810

5. If the simple interest on a certain sum is due for some years at 6% is ₹180, and the discount at 5% on the same amount is ₹140. Find the sum and the time.

   (a) ₹2100 and $1\frac{3}{7}$ years

   (b) ₹2200 and $2\frac{3}{7}$ years

   (c) ₹2000 and $2\frac{3}{7}$ years

   (d) None of these

6. The banker's gain on a certain sum of money is due for 9 months at 4% p.a. is ₹2.25. The sum is:

   (a) ₹2575 (b) ₹2500
   (c) ₹2250 (d) ₹3250

7. At a given rate, the simple interest and the true discount on a certain sum, for a given time, are ₹24 and ₹22, respectively. The sum is:

   (a) ₹264 (b) ₹220
   (c) ₹288 (d) ₹295

8. The present worth of a bill of ₹1764 due for 2 years at 5% compound interest is:

   (a) ₹1650 (b) ₹1700
   (c) ₹1600 (d) ₹1714

9. If ₹21 is the true discount on ₹371 for a certain time, what is the true discount on the same amount for double that time, the rate being the same in both the cases?

   (a) ₹39.00 (b) ₹35.75
   (c) ₹40.00 (d) ₹39.75

10. The T.D. on a certain sum of money due in 2 years is ₹1800 and the simple interest on the same amount is ₹2232. Find the sum.

    (a) ₹9300 (b) ₹9350
    (c) ₹9450 (d) ₹9400

11. The present worth of ₹220.50 due in 2 years reckoning compound interest at 5% is:

    (a) ₹200 (b) ₹197.5
    (c) ₹202 (d) ₹192.25

12. The T.D. on ₹936 is due after a certain time at 8% is ₹36. The money is due after:

    (a) 6 months (b) 3 months
    (c) 1 year (d) 9 months

13. A man bought a motor-cycle for ₹32500. He sold it for ₹35000, allowing the buyer for a 6 months credit. If the money be worth 4% per annum, the gain per cent is:

    (a) $8\frac{1}{7}$% (b) $7\frac{9}{13}$%

    (c) $7\frac{5}{13}$% (d) $8\frac{2}{5}$%

14. Find the present worth of a bill of ₹3720 which is due for 2 years at 12% compound interest, being compounded annually.

    (a) ₹3100 (b) ₹3150
    (c) ₹3125 (d) ₹3225

15. The holder of a bill for ₹17850 nominally due on May 21, 1991 received ₹357 less than the amount of the bill by having it discounted at 5%. When was it doscounted?

    (a) Dec 29, 1990 (b) Dec 30, 1989
    (c) Dec 19, 1990 (d) None of these

16. The true discount on a certain bill due for nine months at 4% simple interest is ₹150. Find the amount of the bill.

    (a) ₹5150 (b) ₹5250
    (c) ₹4750 (d) ₹5650

17. A banker discounts a 4 months bill at 3%. If the proceeds be invested in a manner, so that nothing is lost, the interest rate should be:

(a) 3%   (b) 4%

(c) $3\frac{1}{33}$ %   (d) None of these

18. The difference between the simple interest and the true discount on a certain sum of money for 2 years at 15% per annum at simple interest is ₹45. Find the sum.

(a) ₹700   (b) ₹650

(c) ₹675   (d) ₹625

19. The present worth of a sum of money due for 146 days at 5% is ₹400. The sum due is:

(a) ₹410   (b) ₹408

(c) ₹415   (d) ₹450

20. The present worth of a bill due in sometime is ₹1500. Find the banker's discount on the bill, if the true discount is ₹75.

(a) ₹78.75   (b) ₹77.75

(c) ₹82.75   (d) ₹76.75

21. If the simple interest on ₹2000 at 5% p.a. is equal to the true discount on ₹2500 for the same time and at the same rate, the time is:

(a) $4\frac{1}{2}$ years   (b) 5 years

(c) $7\frac{1}{2}$ years   (d) $2\frac{1}{2}$ years

22. ₹21 is the true discount on ₹371 for a certain time at certain int. If the rate of interest is kept same, true discount on the same sum for double that time will be:

(a) ₹44.38   (b) ₹39.75

(c) ₹33.25   (d) None of these

23. The true discount on a bill of ₹5450 due in 9 months is ₹450. Find the rate of interest.

(a) 12%   (b) 12.5%

(c) 11.5%   (d) 13.1%

24. If ₹10 be allowed as true discount on a bill of ₹110 due at the end of certain time, then the discount allowed on the same amount due at the end of double the time is:

(a) ₹20   (b) ₹21.81

(c) ₹22   (d) ₹18.33

25. A bill which being due at the end of 4 years is now worth ₹575, but if it is due in $2\frac{1}{2}$ years, it would now be worth ₹620. The sum of the bill is:

(a) ₹695   (b) ₹725

(c) ₹713   (d) None of these

26. Find the present worth (P.W.) and the true discount reckoning 6% per annum simple interest of ₹176 due in 20 months time.

(a) ₹160, ₹16   (b) ₹130, ₹46

(c) ₹150, ₹26   (d) None of these

27. What rate of interest does a man get for his money when in discounting a bill due in 10 months, he deducts 4% of the amount of the bill?

(a) 5%   (b) 6%

(c) 8%   (d) 4%

28. The discount on ₹5229 due in 1 year 9 months reckoning compound interest at 5% is:

(a) ₹429.00   (b) ₹415.00

(c) ₹393.25   (d) None of these

29. A bill is discounted at 5% per annum. If banker's discount be allowed, at what rate of interest must the proceeds be invested, so that nothing is lost?

(a) 5%   (b) $4\frac{19}{20}$ %

(c) $5\frac{5}{19}$ %   (d) 10%

30. If the compound interest on a certain sum of money for 2 years at 4% is ₹45.90, the true discount on the same amount of money due 2 years at 4% simple interest is:

(a) ₹39.69   (b) ₹41.67

(c) ₹45.00   (d) ₹38.45

31. The true discount on a bill of ₹2550 due after 3 months is ₹50. Find the banker's discount.

(a) ₹53   (b) ₹51

(c) ₹55   (d) ₹57

32. A owes B ₹1350 due in 3 months and B owes A ₹1078 due 5 months. If they agrees to settle their account right now at 5% p.a., A should pay to B:

(a) ₹$277\frac{1}{3}$ (b) ₹288.25

(c) ₹302   (d) None of these

33. ₹20 is the true discount on ₹260 due after a certain time. What will be the true discount on the same amount due after half of the earlier time, the rate of interest being the same.

(a) ₹10   (b) ₹10.40

(c) ₹15.20   (d) ₹13

34. What is the rate of interest when the P.W. of ₹1245 due in 15 months is ₹1200?

(a) 3%　　　　　　　　(b) 4%

(c) $4\frac{1}{2}$%　　　　　　(d) 5%

35. A has to pay ₹22 to B after 1 year. B asks A to pay ₹110 in cash and defers the payment of ₹110 for 2 years. A agrees to it. Counting the rate of interest at 10% per annum in this new mode of payment,

(a) there is no gain or loss to anyone.
(b) A gains ₹7.34
(c) A loses ₹7.34
(d) A gains ₹11

36. The B.G. on a sum due 3 years at 10% is ₹180. The B.D. is:

(a) ₹680　　　　　　　(b) ₹780
(c) ₹580　　　　　　　(d) ₹480

37. If the discount on ₹249 at 5% S.I. be ₹9, when is the sum due?

(a) 6 months　　　　　(b) 4 months
(c) 9 months　　　　　(d) 7 months

38. The banker's gain on a certain sum due in 2 years at 5% per annum is ₹8. The present worth is:

(a) ₹800　　　　　　　(b) ₹1600
(c) ₹1200　　　　　　 (d) ₹880

39. The B.G. on a certain sum due in 5 years is $\frac{3}{23}$ of B.D. Here, the rate of interest is:

(a) 6%　　　　　　　　(b) 5%
(c) 4%　　　　　　　　(d) 3%

EXERCISE-2
(BASED ON MEMORY)

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1. A fan is listed at ₹1500 and a discount of 20% is offered on the list price. What additional discount must be offered to the customer to bring the net price to ₹1104?

(a) 8%　　　　　　　　(b) 10%
(c) 12%　　　　　　　 (d) 15%

[SSC (GL) Prel. Examination, 2005]

2. A company offers three types of successive discounts: (i) 25% and 15%, (ii) 30% and 10%, (iii) 35% and 5%. Which offer is the best for a customer?

(a) First offer
(b) Second offer
(c) Third offer
(d) Any one; all are equally good

[SSC (GL) Prel. Examination, 2007]

3. A man buys a single apple for ₹25. If he were to buy a dozen apples, he would have to pay a total amount of ₹250. What would be the approximate per cent discount he would get on buying a dozen apples?

(a) 32　　　　　　　　(b) 20
(c) 12　　　　　　　　(d) 17

[Bank of India PO, 2010]

4. An article is marked 40% above the cost price and a discount of 30% is allowed. What is the gain or loss percentage?

(a) 10% gain　　　　　(b) 5% gain
(c) 2% loss　　　　　　(d) 12% loss

[SSC (GL), 2011]

5. The difference between a discount of 40% on ₹500 and two successive discounts of 36%, 4% on the same amount is:

(a) ₹0　　　　　　　　(b) ₹2
(c) ₹1.93　　　　　　 (d) ₹7.20

[SSC (GL), 2011]

6. If on a marked price, the difference of selling prices with a discount of 30% and two successive discounts of 20% and 10% is ₹72, then the marked price (in rupees) is:

(a) 3,600　　　　　　 (b) 3,000
(c) 2,500　　　　　　 (d) 2,400

[SSC (GL), 2010]

7. Successive discounts of 10%, 20% and 30% is equivalent to a single discount of:

(a) 60%　　　　　　　(b) 49.6%
(c) 40.5%　　　　　　(d) 36%

[SSC (GL), 2010]

8. Two successive discounts of a% and b% on the marked price of an article are equivalent to the single discount of:

(a) $(a + b)$%　　　　　(b) $\left(a+b-\dfrac{ab}{100}\right)$%

(c) $\dfrac{a+b}{100}$%　　　　(d) $\dfrac{a+b}{2}$%

[SSC, 2013]

ANSWER KEYS

EXERCISE-1

1. (a)	**2.** (a)	**3.** (d)	**4.** (c)	**5.** (a)	**6.** (a)	**7.** (a)	**8.** (c)	**9.** (d)	**10.** (a)	**11.** (a)	**12.** (a)	**13.** (b)
14. (c)	**15.** (a)	**16.** (a)	**17.** (c)	**18.** (b)	**19.** (b)	**20.** (a)	**21.** (b)	**22.** (b)	**23.** (a)	**24.** (d)	**25.** (c)	**26.** (a)
27. (a)	**28.** (a)	**29.** (c)	**30.** (b)	**31.** (b)	**32.** (a)	**33.** (b)	**34.** (a)	**35.** (b)	**36.** (b)	**37.** (c)	**38.** (a)	**39.** (d)

EXERCISE-2

1. (a)	**2.** (c)	**3.** (d)	**4.** (c)	**5.** (d)	**6.** (a)	**7.** (b)	**8.** (b)

EXPLANATORY ANSWERS

EXERCISE-1

1. (a) T.D. = ₹ $\dfrac{1260 \times \dfrac{1}{2} \times 10}{100 + \dfrac{1}{2} \times 10}$ = ₹60.

2. (a) Interest for 2 years = $\dfrac{240 \times 2}{3}$ = ₹160

Discount for 2 years = ₹150

Sum due = $\dfrac{\text{B.D.} \times \text{T.D.}}{\text{B.D.} - \text{T.D.}} = \dfrac{160 \times 150}{160 - 150}$ = ₹2400

Rate of interest = $\dfrac{240 \times 100}{2400 \times 3} = 3\dfrac{1}{3}$%.

3. (d) ₹21 is the interest on ₹(161 − 21)

or, ₹140 for 2 years 6 months

∴ Rate % = $\dfrac{21 \times 100}{140 \times 5/2}$ = 6%.

4. (c) Present worth = $\dfrac{4 \times 100}{100 + R \times T} = ₹\dfrac{920 \times 100}{100 + 3 \times 5}$

= ₹ $\dfrac{920 \times 100}{115}$ = ₹800.

5. (a) B.D. or Simple Interest at 5%

= $\dfrac{180 \times 5}{6}$ = ₹150

Discount at 5% = ₹140

Sum = $\dfrac{\text{B.D} \times \text{T.D.}}{\text{B.D.} - \text{T.D.}} = \dfrac{150 \times 140}{150 - 140}$ = ₹2100.

Rate per cent = $\dfrac{180 \times 100}{2100 \times 6} = 1\dfrac{3}{7}$ years.

6. (a) B.G. is the interest on T.D.

∴ T.D. = $\dfrac{2.25 \times 100}{\dfrac{3}{4} \times 4}$ = ₹75

B.D. = ₹75 + ₹2.25 = ₹77.25

∴ Sum due = $\dfrac{\text{B.D.} \times \text{T.D.}}{\text{B.G.}}$ = ₹ $\dfrac{77.25 \times 75}{2.25}$

= ₹2575.

7. (a) Sum = $\dfrac{\text{T.D.} \times \text{S.I.}}{\text{S.I.} - \text{T.D.}} = \dfrac{24 \times 22}{24 - 22}$ = ₹264.

8. (c) P.W. = ₹1764 ÷ $\left(1 + \dfrac{5}{100}\right)^2$

= ₹1764 × $\dfrac{400}{441}$ = ₹1600.

9. (d) ₹21 is the interest on ₹(371 − 21) = ₹350

∴ $\dfrac{350 \times \text{no. of years} \times \text{rate}}{100}$ = 21

⇒ Number of years × rate = $\dfrac{2100}{350}$ = 6

∴ Twice number of years × rate = 12

Now, on ₹112, the T.D. is ₹12

∴ on ₹371, the T.D. = ₹ $\dfrac{12}{112}$ × 371

= ₹39.75.

10. (a) Sum = $\dfrac{\text{Simple interest on the sum} \times (\text{T.D.})}{\text{Simple interest on the sum} - (\text{T.D.})}$

= ₹ $\left(\dfrac{2232 \times 1800}{2232 - 1800}\right)$

= ₹ $\left(\dfrac{2232 \times 1800}{432}\right)$

= ₹9300.

11. (a) P.W. = $\dfrac{220.5}{\left(1 + \dfrac{5}{100}\right)^2} = \dfrac{220.5 \times 20 \times 20}{21 \times 21}$

= ₹200.

12. (a) P.W. = ₹(936 − 36) = ₹900

₹36 is S.I. on ₹900

∴ Time = $\frac{36 \times 100}{900 \times 8} = \frac{1}{2}$ year

= 6 months.

13. (b) S.P. of motor = cycle = ₹35000

Gain = ₹35000 − ₹32500

= ₹2500

∴ Gain % = $\frac{2500}{32500} \times 100\%$

= $\frac{100}{13}\% = 7\frac{9}{13}\%$.

14. (c) P.W. = $\frac{A}{\left(1 + \frac{R}{100}\right)^T}$ = ₹ $\frac{3720}{\left[1 + \frac{12}{100}\right]^2}$

= ₹3720 × $\frac{25}{28} \times \frac{25}{28}$ = ₹3125.

15. (a) Clearly, S.I. on ₹17850 at 5% is ₹357.

∴ Time = $\left(\frac{100 \times 357}{17850 \times 5}\right) = \frac{2}{5}$ years = 146 days.

So, the bill is 146 days prior to May 24, the legally due date.

May April March Feb. Jan. Dec.

24 + 30 + 31 + 28 + 31 + 2 = 146 days

So, the bill was discounted on Dec 29, 1990.

16. (a) P.W. = T.D. × $\frac{100}{R \times T}$ = ₹ $\frac{150 \times 100}{\frac{9}{12} \times 4}$

= ₹5,000

∴ Amount of the bill = ₹5000 + ₹150

= ₹5150.

17. (c) 4 months = $\frac{1}{3}$ year

∴ Banker deducts ₹3 × $\frac{1}{3}$ = ₹1 from a bill of ₹100.

So, the banker pays ₹(100 − 1) = ₹99.

So, the bill-holder loses ₹1.

So, for investment ₹1 should be interest on ₹99 for 4 months.

∴ Rate of Interest = $\frac{1 \times 100}{99 \times \frac{4}{12}} = \frac{100}{33} = 3\frac{1}{33}\%$

18. (b) Let the sum be ₹100.

Time = 2 years

Rate = 15% per annum

S.I. = ₹ $\left(\frac{100 \times 15 \times 2}{100}\right)$ = ₹30

Time Discount = ₹ $\left[\frac{100 \times R \times T}{100 + (R \times T)}\right]$

= ₹ $\left[\frac{100 \times 15 \times 2}{100 + (15 \times 2)}\right]$

= ₹ $\left[\frac{100 \times 15 \times 2}{130}\right]$ = ₹ $\frac{300}{13}$.

The difference between S.I. and T.D. is

₹ $\left(30 - \frac{300}{13}\right)$ = ₹ $\frac{90}{13}$

If the difference in S.I. and T.D. is ₹ $\frac{90}{13}$, the sum = ₹100.

If the difference in S.I. and T.D. is ₹1,

The sum = ₹100 × $\frac{13}{10}$

If the difference in S.I. and T.D. is ₹45,

the sum = ₹100 × $\frac{13}{90}$ × 45 = ₹650.

19. (b) T.D. = ₹400 × $\frac{146}{365} \times \frac{5}{100}$ = ₹8

S.D. = ₹400 + ₹8 = ₹408.

20. (a) T.D. = $\sqrt{\text{P.W.} \times \text{B.G.}}$

75 = $\sqrt{1500 \times \text{B.G.}}$

Squaring both the sides,

75 × 75 = 1500 × B.G.

B.G. = ₹ $\frac{75 \times 75}{1500}$ = ₹ $\frac{15}{4}$ = ₹3.75

B.D. = T.D. + B.G.

= 75 + ₹3.75 = ₹78.75.

21. (b) T.D. = ₹500

Rate = 5%

P.W. = ₹2000

∴ Time = $\frac{500 \times 100}{2000 \times 5}$ = 5 years.

22. (b) P.W. of ₹371 = ₹(371 − 21) = ₹350

Also, T.D. = Simple Interest on P.W.

∴ Simple Interest on ₹350 for a certain period at certain rate p.c. = ₹21.

∴ Simple Interest on ₹350 for double the period at same rate p.c. = ₹42.

∴ ₹42 is T.D. on ₹(350 + 42) = ₹392 for double the period.

∴ T.D. on ₹371 for double the period and same rate p.c.

= $\frac{42}{392}$ × 371 = ₹39.75.

23. (a) Amount = ₹5450

P.W. = Amount − T.D.

= ₹5450 − ₹450

= ₹5000

In other words, simple interest on ₹5000 for 9 months is ₹450

∴ Rate = $\dfrac{\text{S.I.}\times100}{P\times T}=\dfrac{450\times100\times4}{5000\times3}$

= 12% per annum.

24. (d) S.I. on ₹(110 − 10) for a given time = ₹10

S.I. on ₹100 for double the time = ₹20

Sum = ₹(100 + 20) = ₹120

T.D. on ₹110 = ₹$\left(\dfrac{20}{120}\times110\right)$ = ₹18.33.

25. (c) Let, the rate p.c. be r %.

Let, ₹x be the amount of the bill.

Then, 575 = $\dfrac{x\times100}{100+4r}$

That is, 57500 + 2300r = 100x

∴ x = 575 + 23r ⋯(1)

and, 620 = $\dfrac{100x}{100+\dfrac{5}{2}r}$

∴ 62000 + 1550r = 100x

∴ 6200 + 155r = 10x

= 5750 + 230r [using (1)]

∴ 75r = 450

∴ r = 6

∴ (1) ⟹ x = 575 + 138 = ₹713.

26. (a) Present Worth = $\dfrac{100\times76}{100+6\times\dfrac{20}{12}}$ = ₹160

True discount = Amount − Present worth

= ₹176 − ₹160

= ₹16

27. (a) Let the amount of the bill be ₹100.

Money deducted = ₹4

Money received by holder of the bill

= ₹(100 − 4) = ₹96

S.I. on ₹96 for 10 months = ₹4

Rate = $\dfrac{100\times4\times6}{96\times5}$ = 5%.

28. (a) P.W. = $\dfrac{5229}{\left(1+\dfrac{5}{100}\right)\left(1+\dfrac{3}{4}\cdot\dfrac{5}{100}\right)}$

= 5229 × $\dfrac{20}{21}\times\dfrac{80}{83}$ = ₹4800

∴ T.D. = ₹(5229 − 4800) = ₹429.

29. (c) Let the sum be ₹100. Then, B.D. = ₹5

Proceeds = ₹(100 − 5) = ₹95

∴ ₹5 must be the interest on ₹95 for 1 year.

So, rate = $\left(\dfrac{100\times5}{95\times1}\right)=5\dfrac{5}{19}$%.

30. (b) Let the sum be ₹x. Then,

45.90 = $x\left\{\left(1+\dfrac{4}{100}\right)^2-1\right\}$

= $\left\{\left(\dfrac{26}{25}\right)^2-1\right\}=\left\{\dfrac{676-625}{625}\right\}$

∴ x = $\dfrac{625\times45.9}{51}$ = ₹562.5

∴ T.D. on ₹562.5

= $\dfrac{562.5\times4\times2}{100+4\times2}=\dfrac{4500}{108}$ = ₹41.67.

31. (b) T.D. = ₹50

P.W. = ₹2550 − ₹50 = ₹2500

Rate of Interest = $\dfrac{50\times100\times4}{2500\times1}$ = 8% per annum

B.D. = ₹$\left[\dfrac{2550}{100}\times8\times\dfrac{1}{4}\right]$ = ₹51.

32. (a) P.W. of ₹1350

= $\dfrac{1350\times100}{100+\dfrac{3}{12}\times5}=\dfrac{1350\times400}{405}$

= ₹$\dfrac{4000}{3}$

P.W. of ₹1078 = $\dfrac{1078\times100}{100+\dfrac{5}{12}\times5}=\dfrac{1078\times1200}{1225}$

= ₹1056

∴ A should pay B = ₹$\left(\dfrac{4000}{3}-1056\right)$

= ₹$\dfrac{832}{3}$ = ₹277$\dfrac{1}{3}$.

33. (b) S.I. on ₹240 for a given time = ₹20

S.I. on ₹240 for half the time = ₹10

∴ ₹10 is T.D. on ₹250

So, T.D. on ₹260 = ₹$\left(\dfrac{10}{250}\times260\right)$ = ₹10.40.

34. (a) T.D. = ₹1245 − ₹1200 = ₹45

P.W. = ₹1200

∴ Rate of interest = $\dfrac{45\times100}{1200\times15/12}$ = 3%.

35. (b) A has to pay the P.W. of ₹220 due 1 year hence, which is

= ₹$\left[\dfrac{100\times220}{100+(10\times1)}\right]$ = ₹200

A actually pays = ₹[110 + P.W. of ₹110 due 2 years].

$$= ₹\left[110 + \frac{100 \times 110}{100 + (8 \times 2)}\right]$$

$$= ₹192.66$$

∴ A gains = ₹[200 − 192.66] = ₹7.34.

36. (b) T.D. = $\dfrac{B.G. \times 100}{R \times T} = ₹\dfrac{180 \times 100}{10 \times 3} = ₹600$

∴ B.D. = ₹(600 + 180) = ₹780.

37. (c) P.W. = ₹249 − ₹9 = ₹240

T.D. = ₹9

Rate = 5%

∴ Time = $\dfrac{T.D. \times 100}{P.W. \times \text{rate}} = \dfrac{9 \times 100}{240 \times 5} = \dfrac{3}{4}$ year

= 9 months.

38. (a) T.D. = $\dfrac{B.G. \times 100}{\text{Rate} \times \text{Time}} = ₹\left(\dfrac{8 \times 100}{5 \times 2}\right)$

$$= ₹800.$$

39. (d) Let, B.D. = ₹1

∵ B.G. = ₹$\dfrac{3}{23}$

∴ T.D. = ₹$\left[1 - \dfrac{3}{23}\right]$ = ₹$\dfrac{20}{23}$

∴ Sum = $\dfrac{B.D \times T.D.}{B.D - T.D.} = \dfrac{1 \times \dfrac{20}{23}}{1 - \dfrac{20}{23}} = ₹\dfrac{20}{3}$

∵ S.I. on ₹$\dfrac{20}{3}$ for 5 years is ₹1.

∴ Rate of interest = $\dfrac{100 \times 3}{20 \times 5} = 3\%$.

EXERCISE-2
(BASED ON MEMORY)

1. (a) M.P. = ₹1500

Discount = 20%

∴ S.P. = ₹1200

Let, 1200 − x% of 1200 = ₹1104

⇒ x% of 1200 = 96 ⇒ x = 8

∴ An additional discount of 8% must be offered to the customer to bring the net price to ₹1104.

3. (d) Cost of one apple = ₹25

∴ Cost of 12 apples = 25 × 12 = ₹300

Amount paid = ₹250

Discount = 300 − 250 = ₹50

% Discount = $\dfrac{50 \times 100}{300}$

= 17% (approx.)

4. (c) Let the C.P. of the article be ₹100. Therefore, marked price = ₹140

S.P. = 70% of 140 = ₹98

loss% = $\dfrac{100 - 98}{100} \times 100$ = 2%

5. (d) Single equivalent discount for 36% and 4%

$$= \left(\dfrac{36 + 4 - 36 \times 4}{100}\right)$$

$$= (40 - 1.44)\% = 38.56\%$$

Therefore, required difference

$$= 1.44\% \text{ of } 500$$

$$= \dfrac{1.44}{100} \times 500 = ₹7.20$$

6. (a) Let the marked price be ₹x

Therefore, in case 1, S.P.

$$= ₹\dfrac{70x}{100}$$

Single discount equivalent to successive discounts of 20% and 10%.

$$= \left(\dfrac{20 + 10 - 20 \times 10}{100}\right)\%$$

$$\text{Ex} = \left(\dfrac{30 - 200}{100}\right)\%$$

$$= (30 - 2)\%$$

$$= 28\%$$

Hence S.P. in this case

$$= ₹\dfrac{72x}{100}$$

Therefore,

$$₹\dfrac{72x}{100} - \dfrac{70x}{100} = ₹72$$

$$\Rightarrow \quad \dfrac{2x}{100} = 72$$

$$\Rightarrow \quad 2x = 7200$$

$$\Rightarrow \quad x = \dfrac{7200}{2}$$

$$= ₹3600$$

7. (b) Single equivalent discount for successive discounts of 10% and 20%

$$= \left(10 + 20 - \frac{20 \times 100}{100}\right)\%$$

$$= 28\%$$

Single equivalent discount for 28% and 30%

$$= \left(28 + 30 - \frac{28 \times 30}{100}\right)$$

$$= 49.6\%$$

8. (b) Let the Marked price of the article be ₹100.

First discount = ₹a.

Second discount $= 100 - a \times \dfrac{b}{100} = b - \dfrac{ab}{100}$

∴ Total discount percent $= \left(a + b - \dfrac{ab}{100}\right)\%$