Discount: True and Banker's

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 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
> $$A = \text{P.W.} + \text{T.D.}$$
> 2. Interest is reckoned on P.W. and T.D. is reckoned on amount.

Banker's Discount

Suppose, a businessman *A* purchases goods worth ₹10000 from businessman *B* at a credit of say 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 On receipt of the goods, *A* gives an agreement and signs the bill accepting that the money can be withdrawn from his account after 3 months of the date of the bill.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 as *nominally due date*) of expiry of 3 months to arrive at a date called *legally due date*. Thus, if 4 April 2004 is the nominally due date then 7 April 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 7 April say 7 March. In such a case, *B* can approach the banker or broker to pay him 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 7 March 2004, then the banker will deduct the interest on the face value for the period 7 March 2004 to 7 April 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 *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 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 due 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

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

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

Illustration 4 The true discount on a certain sum of money due 2 years hence is ₹1800 and 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 due 4 years hence is ₹100 but the interest on the same sum for the same period is ₹125. Find the sum and the rate per cent

Solution: We have,

S.I. on T.D. $=$ S.I. $-$ T.D.

$= 125 - 100 = ₹25.$

$\therefore \qquad$ 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,

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

Illustration 6 Find the present worth of a bill of ₹3380 due 2 years hence at 4% compound interest. Also, calculate 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. $\text{Sum Due} = \dfrac{\text{B.D.} \times \text{T.D.}}{\text{B.D.} - \text{T.D.}}$

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

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

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

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

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

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

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

(i) Banker's discount

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

(iii) Banker's gain.

Solution: Amount = ₹5050

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

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

Date of discounting = 3 September, 2004

No. of days from 3 Sept. to 15 Nov. =

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 4 months hence are ₹48 and ₹45, respectively. Find the sum and the rate of interest.

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

$$= ₹720$$

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

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

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

Solution: B.D. = ₹18, Rate (R) = 3%,

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

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

$$= ₹2400$$

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

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

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

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

⇒ $\text{B.G.} = \dfrac{75 \times 75}{1500} = ₹\dfrac{15}{4} \text{ or, } ₹3.75$

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

$$= 75 + 3.75 = ₹78.75$$

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

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

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

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

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

$$= 36 + 1.08 = ₹37.08$$

Practice Exercises

DIFFICULTY LEVEL-1
(BASED ON MEMORY)

1. The true discount on a bill for ₹1260 due 6 months hence 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 %
   (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 due 2 years 6 months hence is ₹21, 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 due some years hence at 6% is ₹180 and the discount at 5% on the same sum 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 due 9 months hence at 4% is ₹2.25. The sum is:
   (a) ₹2575   (b) ₹2500
   (c) ₹2250   (d) ₹3250

7. At a given rate per cent, 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 2 years hence at 5% compound interest is:
   (a) ₹1650   (b) ₹1700
   (c) ₹1600   (d) ₹1714

9. If ₹21 in the true discount on ₹371 for a certain time, what is the true discount on the same sum for double that time, the rate being the same in both cases?
   (a) ₹39.00   (b) ₹35.75
   (c) ₹40.00   (d) ₹39.75

10. The T.D. on a certain sum of money due 2 years hence is ₹1800 and the simple interest on the same sum 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 due after a certain time at 8% is ₹36. Money is due after:
    (a) 6 months   (b) 3 months
    (c) 1 years   (d) 9 months

13. A man bought a motor-cycle for ₹32500 and sold it for `35000, allowing the buyer 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) $8\frac{2}{3}$%

14. Find the present worth of a bill of ₹3720 which is due 2 years hence 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 21 May, 1991 received ₹357 less than the amount of the bill by having it discounted at 5% When was it doscounted?
    (a) 29 Dec. 1990   (b) 30 Dec. 1989
    (c) 19 Dec. 1990   (d) None of these

16. The true discount on a certain bill due nine months hence 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% discount. If the proceeds be invested so that nothing is lost, the rate p.c. 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 146 days hence at 5% is ₹400. The sum due is:
    (a) ₹410
    (b) ₹408
    (c) ₹415
    (d) ₹450

20. The present worth of a bill due sometime hence 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 rate p.c. If the rate p.c. 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 a certain time, then the discount allowed on the same sum 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 $2\frac{1}{2}$ years hence 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 per cent does a man get for his money when in discounting a bill due 10 months hence, 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 per cent must the proceeds be invested, so that nothing may be lost?
    (a) 5%
    (b) $4\frac{19}{20}\%$
    (c) $5\frac{5}{19}\%$
    (d) 10%

30. An article is listed at ₹65. A customer bought this article for ₹56.16 with two successive discounts of which one is 10% The other discount of this discount scheme that was allowed by the shopkeeper is:
    (a) 4%
    (b) 3%
    (c) 6%
    (d) 2.5%

31. The simple interest and the true discount on a certain sum and at a given rate are ₹25 and ₹20 respectively. The sum is:
    (a) ₹500
    (b) ₹200
    (c) ₹250
    (d) ₹100

32. Two shopkeepers announce the same price of ₹700 for a shirt. The first offers successive discounts of 30% and 6% while the second offers successive discounts of 20% and 16% The shopkeeper that offers better discount is more of:
    (a) ₹22.40
    (b) ₹16.80
    (c) ₹9.80
    (d) ₹36.40

33. A cash payment that will settle a bill for 250 chairs at ₹50 per chair less 20% and 15% with a further discount of 5% on cash payment is:
    (a) ₹8075
    (b) ₹7025
    (c) ₹8500
    (d) None of these

34. A shopkeeper allows a discount of 10% on his goods. For cash payments, he further allows a discount of 20% Find a single discount equivalent of the above offer.
    (a) 30%
    (b) 18%
    (c) 28%
    (d) 15%

35. Successive discounts of 10%, 12% and 15% amount to a single discount of:
    (a) 35.28%
    (b) 36.68%
    (c) 37%
    (d) None of these

36. A tradesman gives 4% discount on the marked price and gives 1 article free for buying every 15 articles and thus gains 30% The marked price is above the cost price by:
    (a) 40%   (b) 39%
    (c) 20%   (d) 50%

37. A discount series of p% and q% on an invoice is the same as a single discount of:

    (a) $\left[p + q + \dfrac{pq}{100} \right]$%   (b) $\left(p - q\dfrac{pq}{100} \right)$%

    (c) $100 - \left(p + q + \dfrac{qp}{100} \right)$%   (d) None of these

38. 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

39. If the compound interest on a certain sum of money for 2 years at 4% is ₹45.90, the true discount on the same sum of money due 2 years hence at 4% simple interest is:
    (a) ₹39.69   (b) ₹41.67
    (c) ₹45.00   (d) ₹38.45

40. 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

41. 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

42. ₹20 is the true discount on ₹260 due after a certain time. What will be the true discount on the same sum due after half of the former time, the rate of interest being the same:
    (a) ₹10   (b) ₹10.40
    (c) ₹15.20   (d) ₹13

43. 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

44. Successive discounts of 10%, 20% and 30% is equivalent to a single discount of:
    (a) 60%   (b) 49.6%
    (c) 40.5%   (d) 36%

45. 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

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

    (a) ₹277$\dfrac{1}{3}$

    (b) ₹288.25
    (c) ₹302
    (d) None of these

47. What is the rate of interest when the P.W. of ₹1245 due 15 months hence is ₹1200?
    (a) 3%   (b) 4%

    (c) $4\dfrac{1}{2}$%   (d) 5%

48. A has to pay ₹22 to B after 1 year. B asks A to pay ₹110 in cash and defer 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

49. The B.G. on a sum due 3 years hence at 10% is ₹180. The B.D. is:
    (a) ₹680   (b) ₹780
    (c) ₹580   (d) ₹480

50. The banker's gain on a certain sum due 2 years hence at 5% per annum is ₹8. The present worth is:
    (a) ₹800   (b) ₹1600
    (c) ₹1200   (d) ₹880

51. The true discount on a certain sum of money due $12\dfrac{1}{2}$ years hence is ₹150 and the simple interest on the same sum for the same time and at the same rate is ₹200. Interest rate per annum is:

(a) 10%   (b) 12%

(c) $12\frac{1}{2}\%$ (d) $8\frac{1}{2}\%$

[Based on MAT, 2011)]

52. ₹20 is the true discount on ₹260 due after a certain time. What will be the true discount on the same sum due after half of the former time, the rate of interest being the same?

(a) ₹15.20   (b) ₹10.40

(c) ₹10.83   (d) ₹13

[Based on MAT, 2011)]

53. A shopkeeper allows a discount of 10% on the marked price of an item but charges a sales tax of 8% on the discounted price. If the customer pays 680.40 as the price including the sales tax, then what is, the marked price of the item?

(a) ₹630   (b) ₹700

(c) ₹780   (d) None of these

[Based on MAT, 2014)]

54. An article is listed at ₹65. A customer bought this article for ₹56.16 and got two successive discounts of which the first one is 10% The other rate of discount of this scheme that was allowed by the shopkeeper was:

(a) 3%   (b) 4%

(c) 6%   (d) 2%

[Based on SNAP, 2012)]

Answer Keys

DIFFICULTY LEVEL-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.** (a)	**31.** (d)	**32.** (c)	**33.** (a)	**34.** (c)	**35.** (d)	**36.** (d)	**37.** (d)	**38.** (d)	**39.** (b)
40. (c)	**41.** (d)	**42.** (b)	**43.** (a)	**44.** (b)	**45.** (b)	**46.** (a)	**47.** (a)	**48.** (b)	**49.** (b)	**50.** (a)	**51.** (c)	**52.** (b)
53. (b)	**54.** (b)											

Explanatory Answers

DIFFICULTY LEVEL-1

1. (a) T.D. $= ₹\dfrac{1260\times\frac{1}{2}\times10}{100+\frac{1}{2}\times10} = ₹60.$

2. (a) Interest for 2 years $= \dfrac{240\times2}{3} = ₹160$

Discount for 2 years = ₹150

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

$= \dfrac{160\times150}{160-150} = ₹2400$

Rate of interest $= \dfrac{240\times100}{2400\times3} = 3\frac{1}{3}\%$

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

or, ₹140 for 2 years 6 months

∴   Rate % $= \dfrac{21\times100}{140\times5/2} = 6\%$

4. (c)   Present worth $= \dfrac{A\times100}{100+R\times T} = ₹\dfrac{920\times100}{100+3\times5}$

$= ₹\dfrac{920\times100}{115} = ₹800.$

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

$= \dfrac{180\times5}{6} = ₹150$

Discount at 5% = ₹140

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

$= \dfrac{150\times140}{150-140} = ₹2100.$

Rate per cent $= \dfrac{180\times100}{2100\times6}$

$= 1\frac{3}{7}$ years.

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

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

B.D. $= ₹75 + ₹2.25 = ₹77.25$

$\therefore$ 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. $= ₹1764 \div \left(1 + \dfrac{5}{100}\right)^2$

$= ₹1764 \times \dfrac{400}{441} = ₹1600.$

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

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

$\Rightarrow$ No. of years × rate $= \dfrac{2100}{350} = 6$

$\therefore$ Twice no. of years × rate = 12

Now, on ₹112, the T.D. is ₹12

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

$= ₹39.75.$

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

$\therefore$ Time $= \dfrac{36 \times 100}{900 \times 8} = \dfrac{1}{2}$ year

$= 6$ months.

13. (b) S.P. of motorcycle = ₹35000

Gain = ₹35000 − ₹32500

$= ₹2500$

$\therefore$ Gain % $= \dfrac{2500}{32500} \times 100\%$

$= \dfrac{100}{13}\% = 7\dfrac{9}{13}\%$

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

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

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

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

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

May April March Feb. Jan. Dec.
24 + 30 + 31 + 28 + 31 + 2 = 146 days
So, the bill was discounted on 29 Dec. 1990.

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

$= ₹5,000$

$\therefore$ Amount of the bill = ₹5000 + ₹150

$= ₹5150.$

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

$\therefore$ Banker deducts $₹3 \times \dfrac{1}{3} = ₹1$ from a bill of ₹100

So, the banker pays ₹(100 − 1) = ₹99

So, the bill holder loses Re. 1

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

$\therefore$ Rate $= \dfrac{1 \times 100}{99 \times \dfrac{4}{12}} = \dfrac{100}{33} = 1\dfrac{1}{33}\%$

18. (b) Let, the sum be ₹100

Time = 2 years

Rate = 15% per annum

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

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

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

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

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 Re. 1, the sum $= ₹100 \times \frac{13}{10}$.

If the difference in S.I. and T.D. is $₹45$, the sum $= ₹100 \times \frac{13}{90} \times 45 = ₹650$.

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

S.D.$= ₹400 + ₹8 = ₹408$.

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

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

Squaring both the sides

$$75 \times 75 = 1500 \times B.G.$$

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

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

$$= 75 + ₹3.75 = ₹78.75.$$

21. (b)   T.D. $= ₹500$

Rate $= 5\%$

P.W. $= ₹2000$

$\therefore$ 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.

$\therefore$ Simple interest on $₹350$ for a certain period at certain rate p.c. $= ₹21$

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

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

$\therefore$ T.D. on $₹371$ for double the period and same rate p.c. $= \frac{42}{392} \times 371 = ₹39.75.$

23. (a)   Amount $= ₹5450$

P.W. $= $ Amount $-$ T.D.

$= ₹5450 - ₹450$

$= ₹5000$

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

$\therefore$ Rate $= \frac{S.I. \times 100}{P \times T} = \frac{450 \times 100 \times 4}{5000 \times 3}$

$= 12\%$ 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 $₹110 = ₹\left(\frac{20}{120} \times 110\right) = ₹18.33.$

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

Let, $₹x$ be the amount of the bill.

Then, $575 = \frac{x \times 100}{100 + 4r}$

i.e., $57500 + 2300r = 100x$

$\therefore$ $x = 575 + 23r$ (1)

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

$\therefore$ $62000 + 1550r = 100x$

$\therefore$ $6200 + 155r = 10x$

$= 5750 + 230r$ [Using (1)]

$\therefore$ $75r = 450$

$\therefore$ $r = 6$

$\therefore$ From $1 \Rightarrow x = 575 + 138$

$= ₹713.$

26. (a)   Present worth $= \frac{100 \times 76}{100 + 6 \times \frac{20}{12}} = ₹160$

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 $= \frac{100 \times 4 \times 6}{96 \times 5} = 5\%$

28. (*a*)
$$\text{P.W.} = \frac{5229}{\left(1+\frac{5}{100}\right)\left(1+\frac{3}{4}\cdot\frac{5}{100}\right)}$$
$$= 5229 \times \frac{20}{21} \times \frac{80}{83} = ₹4800$$
$$\therefore \quad \text{T.D.} = ₹(5229 - 4800) = ₹429.$$

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 = $\left(\frac{100 \times 5}{95 \times 1}\right) = 5\frac{5}{19}\%$

30. (*a*) Let, the other discount be $x\%$
$$\therefore \quad 65 \times \frac{90}{100} \times \frac{(100-x)}{100} = 56.16$$
$$\Rightarrow \quad 100 - x = \frac{56.16 \times 100 \times 100}{65 \times 90}$$
$$\Rightarrow \quad 100 - x = 96$$
$$\Rightarrow \quad x = 4\%$$

31. (*d*) Let, the amount be ₹x and rate is $r\%$

Then, for simple intrest
$$\frac{x \times r}{100} = 25$$
$$\Rightarrow \quad x \times r = 2500 \qquad (1)$$
For true discount
$$\frac{(x-20) \times r}{100} = 20$$
$$\Rightarrow \quad \frac{x \times r - 20r}{100} = 20$$
$$\Rightarrow \quad xr - 20r = 2000 \qquad (2)$$
From Eqs. (1) and (2), we get
$$2500 - 20r = 2000$$
$$\Rightarrow \quad r = 25\%$$
From Eq. (1)
$$x \times 25 = 2500 \Rightarrow x = 100$$

32. (*c*) Selling price of first shopkeeper
$$= 700 \times \frac{70}{100} \times \frac{94}{100} = ₹460.60$$
Selling price of second shopkeeper
$$= 700 \times \frac{80}{100} \times \frac{84}{100} = ₹470.40$$
Required difference
$$= 470.40 - 460.60 = ₹9.80$$

33. (*a*) Original price of 250 chairs
$$= 250 \times 50 = ₹12500$$

Price after discount
$$= 12500 \times \frac{80}{100} \times \frac{85}{100} \times \frac{95}{100}$$
$$= ₹8075$$

34. (*c*) **Quicker Method:** Discount equivalent to two successive discounts of $x\%$ and $y\%$ is given by
$$\left(x + y - \frac{x \times y}{100}\right)\%$$
∴ Required equivalent discount
$$= 10 + 20 - \frac{10 \times 20}{100} = 30 - 2 = 28\%$$

35. (*d*) We know that discount equivalent to two sucessive discounts of $x\%$ and $y\%$ is given by
$$\left(x + y - \frac{xy}{100}\right)\%$$
Now, from the question,

Equivalent discount of two successive discounts 10% and 12%
$$= \left(10 + 12 - \frac{10 \times 12}{100}\right) = 20.8\%$$
Now, equivalent discounts of 20.8% and 15%
$$= 20.8 + 15 - \frac{20.8 \times 15}{100}$$
$$= 35.8 - 4.12 = 31.68\%$$

36. (*d*) Let, C.P. of (15 + 1) articles = ₹1600
$$\therefore \quad \text{S.P. of 15 articles} = \frac{1600 \times 135}{100}$$
$$\text{S.P. of 1 article} = \frac{1600 \times 135}{100 \times 15} = 144$$
$$\text{Now, M.P.} = \frac{144 \times 100}{96} = 150\%$$
∴ M.P. above the C.P. = 50%

37. (*d*) Single discount series of $p\%$ and $q\%$
$$= \left(p + q - \frac{pq}{100}\right)\%$$

38. (*d*)   Cost of one apple = ₹25
$$\therefore \quad \text{Cost of 12 apples} = 25 \times 12 = ₹300$$
Amount paid = ₹250

Discount = 300 − 250 = ₹50
$$\% \text{ Discount} = \frac{50 \times 100}{300}$$
$$= 17\% \text{ (approx.)}$$

39. (b) Let, the sum be ₹x. Then,

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

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

$$\therefore \qquad x = \frac{625 \times 45.9}{51} = ₹562.5$$

$\therefore$ T.D. on ₹562.5

$$= \frac{562.5 \times 4 \times 2}{100 + 4 \times 2} = \frac{4500}{108} = ₹41.67.$$

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

$$\text{S.P.} = 70\% \text{ of } 140 = ₹98$$

$$\text{Loss\%} = \frac{100-98}{100} \times 100 = 2\%$$

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

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

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

Therefore, required difference

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

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

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

S.I. on ₹240 for half the time = ₹10

$\therefore$ ₹10 is T.D. on ₹250

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

43. (a) Let, the marked price be ₹x

Therefore, in case 1, S.P.

$$= ₹\frac{70x}{100}$$

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

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

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

$$= (30 - 2)\% = 28\%$$

Hence S.P. in this case

$$= ₹\frac{72x}{100}$$

Therefore,

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

$$\Rightarrow \qquad \frac{2x}{100} = 72$$

$$\Rightarrow \qquad 2x = 7200$$

$$\Rightarrow \qquad x = \frac{7200}{2} = ₹3600.$$

44. (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%

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

$$= 49.6\%$$

45. (b) $\qquad$ T.D. = ₹50

$$\text{P.W.} = ₹2550 - ₹50 = ₹2500$$

$$\text{Rate of Interest} = \frac{50 \times 100 \times 4}{2500 \times 1}$$

$$= 8\% \text{ per annum}$$

$$\text{B.D.} = ₹\left[\frac{2550}{100} \times 8 \times \frac{1}{4}\right] = ₹51.$$

46. (a) $\quad$ P.W. of ₹1350 $= \dfrac{1350 \times 100}{100 + \dfrac{3}{12} \times 5} = \dfrac{1350 \times 400}{405}$

$$= ₹\frac{4000}{3}$$

$$\text{P.W. of ₹1078} = \frac{1078 \times 100}{100 + \dfrac{5}{12} \times 5} = \frac{1078 \times 1200}{1225}$$

$$= ₹1056$$

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

$$= ₹\frac{832}{3} = ₹277\frac{1}{3}$$

47. (a) $\qquad$ T.D. = ₹1245 − ₹1200 = ₹45

$$\text{P.W.} = ₹1200$$

$$\therefore \qquad \text{Rate \%} = \frac{45 \times 100}{1200 \times 15/12} = 3\%$$

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

$$= ₹\left[\frac{100 \times 220}{100 + (10 \times 1)}\right] = ₹200$$

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

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

$$= ₹192.66$$

∴   *A* gains = ₹[200 − 192.66] = ₹7.34.

49. (*b*) $\text{T.D.} = \frac{\text{B.G.} \times 100}{R \times T} = ₹\frac{180 \times 100}{10 \times 3} = ₹600$

∴   B.D. = ₹(600 + 180) = ₹780.

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

$$= ₹800.$$

51. (*c*) We have, TD = ₹150, SI = ₹200 and $t = 2\frac{2}{3}$ years

i.e., $\frac{8}{3}$ years

Therefore, from the formula,

$SI - TD = \frac{TD \times r \times t}{100}$, we get

$$50 = \frac{150 \times r \times 8}{300 \times 3}$$

$$\Rightarrow \quad r = \frac{100}{8}\%, \text{ i.e., } 12\frac{1}{2}\%$$

52. (*b*) If time and rate be *T* and *R* respectively, then we have

$$TD = \frac{\text{Amount} \times R \times T}{100 + (R \times T)}$$

$$\Rightarrow \quad 20 = \frac{260 \times RT}{100 + RT}$$

$$\Rightarrow \quad 100 + RT = 13RT$$

$$\Rightarrow \quad 12RT = 100$$

$$\Rightarrow \quad RT = \frac{100}{12} = \frac{25}{3}$$

In second condition, rate is same but time is half, therefore we get

$$R\frac{T}{2} = \frac{25}{3}\frac{1}{2} = \frac{25}{6}$$

Therefore, required $TD = ₹\dfrac{260 \times 25}{\left(100 + \dfrac{25}{6}\right) \times 6}$

$$= ₹\frac{260 \times 25 \times 6}{625 \times 6}$$

$$= ₹\frac{260}{25} = ₹10.40$$

53. (*b*) Let, the marked price on item = ₹100

Discount allowed = 10% = ₹10

∴   Discounted price of item = 100 − 10 = ₹90

Sales tax = 8% on

$$₹90 = \frac{90 \times 8}{100} = \frac{72}{10} = ₹7.20$$

∴ Total paid amount = 90 + 7.20 = ₹97.20

When ₹97.20 is paid, then the marked price = ₹100

and, ₹1 is paid, then the marked price $= ₹\dfrac{100}{97.20}$

when ₹680.40 is paid, then the marked price

$$= ₹\frac{100}{97.20} \times 680.40$$

$$= ₹\frac{100 \times 6804}{972} = ₹700$$

54. (*b*) Price of the article after first discount,

$$65 - \left(65 \times \frac{10}{100}\right) = ₹58.5$$

Therefore, the second discount

$$= \frac{58.5 - 56.16}{58.5} \times 100 = 4\%$$