

Banker's Discount & True Discount

Suppose pikul bought a laptop whose present worth is Rs. 50,000. He is unable to pay the money instantly so he signed a bill that he will pay money after one year at 10% P.a.

$$\text{Present worth (P.W.)} = 50,000$$

$$\text{Face Value (Amount)} = 50,000 + \frac{10\% \text{ of } 50,000}{\text{T.D.}} \\ = 55,000$$

$$\text{True discount (T.D.)} = \text{RT\% of P.W.}$$

$$\text{T.D.} = \text{SI on P.W.}$$

$$55,000 - 50,000 = 5,000 \leftarrow \text{T.D.}$$

$$\text{T.D.} = \text{Amount} - \text{P.W.}$$

Suppose the shopkeeper need money. so he visited to the bank with the bill to draw money. The bank agree to pay the bill at 10% p.a. on the face value.

$$\text{The Bank redeem the bill} = \frac{10\% \text{ of } 55,000}{\text{B.D.}} = 5,500$$

$$\text{Banker's Discount (B.D.)} = \text{RT\% of Amount}$$

$$50,000 - 49,500 = 500 \leftarrow \text{Banker's gain}$$

$$\text{B.G.} = 5,500 - 5,000 = 500$$

True discount = RT% of Amount

$$\frac{\text{T.D.}}{\text{Amount}} = \frac{\text{P.W.}}{\text{P.W.} \times (100 + \text{RT})\%}$$

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$$\boxed{\frac{T.D.}{B.D.} = \frac{100}{100 + RT}}$$

$T.D = RT\% \text{ of } P.W. \text{ ——— 1)}$

$B.G = RT\% \text{ of } T.D \text{ ——— 2)}$

$\Rightarrow T.D = \frac{B.G}{RT\%} \text{ ——— 2)}$

from equation 1) & 2) we get

$RT\% \text{ of } P.W. = \frac{B.G}{RT\%}$

$\frac{T.D}{B.G} = \frac{RT\% \text{ of } P.W.}{RT\% \text{ of } T.D} \Rightarrow T.D^2 = P.W \times B.G$

$\Rightarrow \boxed{T.D = P.W \times B.G}$

① The banker's Discount on a bill due 4 months hence at 15% is Rs. 420. The Discount is :

Soln:- $\frac{B.D}{T.D} = \frac{100 + 15 \times \frac{1}{3}}{100}$

$\Rightarrow \frac{420}{T.D} = \frac{105}{100} \Rightarrow T.D = 420 \times \frac{20}{21} = 400$

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② The true discount on a bill of Rs. 540 is Rs. 90. The banker's Discount is :

Soln:- $T.D = \text{Amount} - P.W.$

$P.W = \text{Amount} - T.D$

$\frac{90}{B.D} = \frac{450}{540}$

$\Rightarrow B.D = \frac{90 \times 540}{450} = 108$

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③ The Banker's Discount on Rs. 1,600 at 15% p.a. is the same as true discount on Rs. 1680 for the same time and at the same rate. The time is :

Soln:- $B.D \times 1600 = T.D \times 1680$

$$\Rightarrow \frac{T.D.}{B.D} = \frac{1600}{1680} = \frac{20}{21}$$

$$\Rightarrow \frac{PW}{Amount} = \frac{20}{21}$$

$$\Rightarrow \frac{100}{100+RT} = \frac{20}{21}$$

$$\Rightarrow \frac{100+RT}{100} = \frac{21}{20} - 1$$

$$\Rightarrow \frac{RT}{100} = \frac{1}{20} \Rightarrow RT = 5$$

Alternetively

$B.D \text{ on Rs. } 1600 = T.D \text{ on Rs. } 1680$

$$\frac{Amount}{PW} = \frac{BD}{TD} = \frac{1680}{1600}$$

$$\Rightarrow \frac{Amount - PW}{PW} = \frac{80}{1600}$$

$$\frac{100 + RT}{100} = \frac{1680}{1600}$$

$$\Rightarrow \frac{RT}{100} = \frac{80}{1600} = \frac{1}{20} \Rightarrow RT = 5$$

$$15T = 5$$

$$\Rightarrow T = \frac{5}{15} = \frac{1}{3} \text{ years}$$

or
4 months

④ The true discount on a bill due 9 months at 16% Per annum is Rs. 189. The amount of the bill is :

Soln:- 9 months = $\frac{3}{4}$ year

$$16 \times \frac{3}{4} \% \text{ of } PW = 189$$

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$$\text{Amount} = 1575 + 12\% \text{ of } 1575$$

$$\text{Amount} = \text{PW} + \text{T.D.} = 1575 + 189 = 1764$$

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- ⑤ The banker's discount of a certain sum of money is Rs. 72 and the true discount on the same sum for the same time is Rs. 60. The sum due is :

Soln:- $\frac{\text{T.D.}}{\text{B.D.}} = \frac{60}{72} \quad \frac{\text{T.D.}}{\text{B.D.}} = \frac{100}{100 + \text{RT}} = \frac{60}{72}$

$$\frac{\text{B.D.}}{\text{T.D.}} = \frac{72}{60} \Rightarrow \frac{100 + \text{RT}}{100} = \frac{72}{60} \Rightarrow \frac{\text{RT}}{100} = \frac{12}{60}$$

$$\Rightarrow \text{RT} = \frac{1}{5} \times 100 = 20\%$$

$$\text{RT}\% \text{ of Amount} = 72$$

$$\Rightarrow 20\% \text{ of Amount} = 72$$

$$\Rightarrow \text{Amount} = 360$$

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- ⑥ The present worth of a certain Bill due sometime hence is Rs. 800 and the true discount is Rs. 36. The banker's discount is :

Soln:- $\text{RT}\% \text{ of } 800 = 36$

$$\Rightarrow \text{RT}\% = \frac{36}{800}$$

$$\Rightarrow \text{RT} = \frac{36}{800} \times 100 = 4.5$$

$$\text{Amount} = 800 + 36 = 836$$

$$\text{B.D.} = 4.5\% \text{ of } 836$$

$$= \frac{9}{200} \times 836 = 37.62$$

⑦ The present worth of a sum due some time hence is Rs. 576 and the banker's gain is Rs. 16. The true discount is :

Soln:- $TD = \sqrt{PW \times BG} = \sqrt{576 \times 16} = 96$

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⑧ The banker's gain of a certain sum due 2 years hence at 10% p.a. is Rs. 24. The present worth is :

Soln:- $B.G = RT\% \text{ of } T.D.$ | $RT\% \text{ of } P.W = T.D$
 $\Rightarrow 20\% \text{ of } T.D = 24$ | $\Rightarrow 20\% \text{ of } P.W = 24$
 $\Rightarrow T.D = 120$ | $\Rightarrow P.W = 600$

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⑨ The banker's gain on a certain sum due $1\frac{1}{2}$ years hence is $\frac{3}{25}$ of the banker's discount. The rate percent is :

Soln:- $B.G = RT\% \text{ of } T.D$ | $\frac{BG}{BD} = \frac{3}{25} \Rightarrow 22 = T$
 $\frac{TD}{BG} = \frac{100}{RT}$
 $\frac{22}{3} = \frac{100}{RT}$

$\Rightarrow \frac{3R}{2} = \frac{3}{22} \times 100$

$\Rightarrow R = \frac{3}{22} \times \frac{2}{3} \times 100 = 9.09\%$

⑩ The banker's discount on a certain sum due 2 years hence is $\frac{11}{10}$ of the true discount. The rate percent is:

Soln:- $\frac{BD}{TD} = \frac{100 + RT}{100} = \frac{11}{10}$

$\Rightarrow 100 + 2R = 110 \Rightarrow 2R = 10 \Rightarrow R = 5\%$

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⑪ A trader owes a merchant Rs. 9810 due in 1 year but the trader wants to settle the account after 6 months. If the rate of interest is 9% p.a. How much cash should he pay?

Soln:- Present worth of 9810 after 1 year

$= \frac{9810 \times 100}{100 + \frac{6}{12} \times 9} = \frac{9810 \times 100}{104.5} = 9405$

$= \frac{9810 \times 100}{100 + 1 \times 9} = 9000$

Amount after 6 months = $9000 \times RT\%$ of 9000
 $= 9000 + \frac{1}{2} \times 9\% \text{ of } 9000 = 9000 + 405 = 9405$

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⑫ Goods were bought for Rs. 600 and sold the same for Rs. 688.50 at a credit of 9 months and thus gaining 2%. The rate of interest per annum is:

Soln:- CP = 600

SP = 600 + 2% of 600

= 612

PW = 612

$688.50 = 612 + RT\%$ of 612

$\Rightarrow \frac{3}{4} R\% \text{ of } 612 = 76.50$

$\Rightarrow R = \frac{76.50}{612} \times \frac{4}{3} \times 100$