PERCENTAGE

Content

1)Introduction

1.i) What is Percentage ?

Percentage

per – cent (100)

Why percentage?

To convert any base values to **100**

1.ii) Application:

The concept of percentage is applied in many other important topics like **profit and loss, data interpretation, simple and compound interest** etc.

The shortcuts which you are going to learn will be very useful if it is applied in these topics.

2) Shortcuts

2.i) Shortcut 1: Splitting of values

a) 20% of 80 = ?

100% of 80 = 80

10% of 80 = 8

20% of 80 = 16

Try 30% of 60

b) 15% of 80 = ?

10% of 80= 8

5% of 80 = 4

15% of 80 = 12

Try 15% of 60

c) 12% of 80 = ?

10% of 80 = 8 1% of 80 = 0.8

2% of 80 = 1.6

12% of 80 = 9.6

Try 13% of 60

d) 45% of 80 = ?

50% of 80 = 40

5% of 80 = 4

45% of 80 = 36

Try 45% of 60

e) 18% of 80 = ?

10% of 80 = 8

20% of 80 = 16

2% of 80 = 1.6

18% of 80 = 14.4

Try 27% of 60

2.ii) Shortcut 2: Decimal

3.555% of 80 = ?

10% of 80 = 8 1% of 80 = 0.8

3% of 80 = 2.4 5% of 80 = 4

0.5% of 80 = 0.4

0.05% of 80 = 0.04

0.005% of 80 = 0.004

3.555% of 80 = 2.844

Try 5.333% of 60

2.iii) Shortcut 3:

How do you solve **12.5% of 80** = ?
10% + 2% + 0.5% ?

How much time will the following question take?
12.5% of 8.8 = ?

Now this
16.66% of 3.6 = ?

12.5% of 80 = ?
1 = 100%
1/2 = 50%
1/4 = 25%
1/8 = 12.5%

∴ 12.5% of 80 = 1/8 of 80
= 10

Similarly **12.5% of 8.8** = 1/8 of 8.8

= 1.1

16.66% of 3.6 = 1/6 of 3.6

= 0.6

Lets learn to convert few more fraction values

1 = 100%
1/2 = 50%
1/3 = 33.33%
1/4 = 25% (half of ½)
1/5 = 20%
1/6 = 16.66% (half of 1/3)
1/7 = 14.28%
1/8 = 12.5% (half of ¼)
1/9 = 11.11% (1/3rd of 1/3)
1/10 = 10%
1/11 = 9.09%

Note: 1/9 x will be in the multiples of 11

1/11 x will be in the multiples of 9

1/9 = 11.11%, 2/9= 22.22%, 3/9= 33.33%.....

1/11 = 9.09% 2/11= 18.18%, 3/11= 27.27%.....

2.iv) Shortcut 4:

How do you solve **62% of 150 = ?**
10% to 60%
1% to 2%
Then 60% + 2% ?

No
a% of b can be written as b% of a
Proof: a% of b = b% of a
a/100 x b = b/100 x a
ab/100 = ab/100

∴ 62% of 150 = 150% of 62
= 100% + 50% of 62
= 62 + 31
= 93
Why should we interchange 62 and 150?
Because splitting 150 is easier than splitting 62
So whenever the right hand side value is easier, interchange the values.

Try 84% of 250
Try 72% of 90

Example 1:

Try 35% of 40
Try 2.4242% of 80
Try 33.33% of 12
Try 75% of 16
Try 66.66% of 9
Try 37.5% of 24
Try 55.55% of 18
Try 45.45% of 121
Try 3.6% of 133.33

Solution for the last question:

3.6% of 133.33 = 133.33% of 3.6

= 100% of 3.6 + 33.33% of 3.6

= 3.6 + $1/3^{rd}$ of 3.6

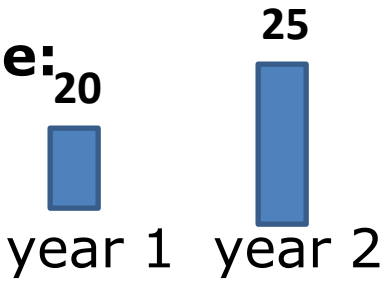
= 3.6 + 1.2

= 4.8

3)Percentage increase and decrease

3.i) Increase and decrease

Example:



What is the percentage increase from the 1st year to the 2nd ?

What is the increase? 5
From where it is increasing? 20

Percentage increase = 5/20 * 100
= ¼ * 100
= 25%

What is the percentage decrease from the 2nd year to the 1st?

What is the decrease? 5
From where it is decreasing? 25

Percentage increase = 5/25 * 100
= 1/5 * 100
= 20%

Example 2: Ram makes $50 a week from his job. He earns a raise and now makes $60 a week. What is the percent increase?

A. 16.66%
B. 20%
C. 25%
D. 50%

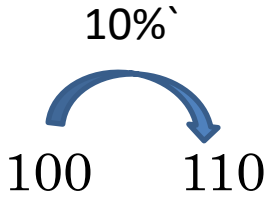
Solution:

Percentage increase = 10/50 * 100
= 20%

3.ii) Increase/ decrease shortcut:

If there are 100 chocolates with me and it is increased by 10%, then what will be the total number of chocolates now?

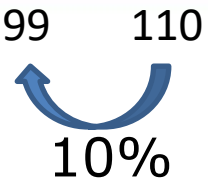
110?
Yes



Now from 110 to get back to 100, what should be the percentage decrease?

10% again?

No
Because from 110 if 10% is decreased it will become 99. (-10% of 110 = -11)



To find the decrease easily lets learn a shortcut.

Between two values if the **increase** is **1/n**, then the **decrease** will be **1/n+1**.

∴ Increase % = 10% = **1/10**
Decrease % = **1/11** = 9.09%

∴ From 110 to 100 the decrease % should be 9.09%

Similarly for the previous question if you observe

Increase % = 25% = **1/4**
Decrease % = **1/5** = 20%

Example 3: If A's height is 33.33% less than that of B, how much percent B's height is more than that of A?

A) 20%
B) 25%
C) 33.33%
D) 50%

Solution:

33.33% decrease = 1/3
∴ Increase = 1/2
= 50%

Important application of 1/n shortcut:

If the price of a commodity increases by 1/n, then the consumption should be reduced by 1/n+1 to make the expenditure same.

Expenditure = Price * Consumption

1/n 1/n+1

This can be applied in many other topics like time speed and distance in the formula D = S * T etc.

Example 4: A person buys 750 litres of milk every year and the price of the milk is Rs 20 per litre. If the price of the milk increases to Rs 25 per litre next year, what amount of milk he/she can buy for the same expense as in the previous year?

A. 500 litres
B. 562.50 litres
C. 600 litres
D. 9000 litres

Solution: Price increase = 5/20
= ¼
∴ Consumption decrease = 1/5

$1/5^{th}$ of 750 litres = 150 litres should be decreased

Consumption = 750 – 150 litres
= 600 litres

3.iii) Successive increase/decrease:

Example: A car is moving at some constant speed. At first it increases its speed by 25% and then again it increases its speed by 20%. What is the overall percentage increase.

Method 1:

Initial speed of the car = x
Speed of the car after 1st increase = x + 0.25x = 1.25x
Speed of the car after 2nd increase = 1.25x + 0.25x = 1.50x

Initial speed = x
Final speed = 1.50x

Percentage increase = 50%

Method 2:

Assume the initial speed of the car as 100kmph

Initial speed of the car = 100
Speed of the car after the 1st increase = 125
Speed of the car after the 2nd increase = 150

Initial speed = 100
Final speed = 150

Percentage increase = 50%

Method 3: Shortcut

If the 1st increase/ decrease is **a%** and the 2nd increase/decrease is **b%** the overall increase/decrease % will be

a + b + ab/100 %

In this question **a = 25%** and **b= 20%**

Overall increase/decrease = 25 + 20 + (25)(20)/100

= 25 + 20 + 5

= **50 %**

Note: If a or b is increase, then include +ve sign

If a or b is decrease, then include -ve sign.

Note : The final answer will be in percentage

Example 5: A city's population was 10,000 at the end of 2008. In 2009, it increased by 25% and in 2010, it decreased by 8%. What was the city's population at the end of 2010?

A.8500
B.11500
C.11700
D. 13333

Solution: 25 + (-8) + (25) (-8)/100 %

= 25 – 8 – 200/100 %

= 25 – 8 – 2 %

= 15 %

Important application of a + b + ab/100 % shortcut:

If the price of a commodity increases/decreases by a% and the consumption increases/reduces by b% then the expenditure will increase/decrease by **a + b + ab/100 %**

Expenditure = Price * Consumption

This can be applied in many other topics like time speed and distance in the formula D = S * T etc.

Example 6: Water tax is increased by 20% but its consumption is decreased by 20%. Then, the increase or decrease percentage in the expenditure of the money is:

a) No change
b) 5% decrease
c) 4% increase
d) 4% decrease

Solution: $20 + (-20) + (20)(-20)/100\ \%$

$= 20 - 20 - 400/100\ \%$

$= 20 - 20 - 4\ \%$

$= -4\ \%$

$= 4\%$ decrease

4) Solved examples

Q.1 Evaluate 35% of 280 + 80% of 140

A. 70
B. 140
C. 210
D. 280

Solution:

35% of 280 + 80% of 140 = 35% of 280 + 40% of 280
= 75% of 280
= ¾ of 280
= 210

Q.2 If 30% of a = b, then b% of 30 is the same as :

A. 4% of a
B. 6% of a
C. 8% of a
D. 9% of a

Solution:

Given : b = 30% of a
To find : b% of 30

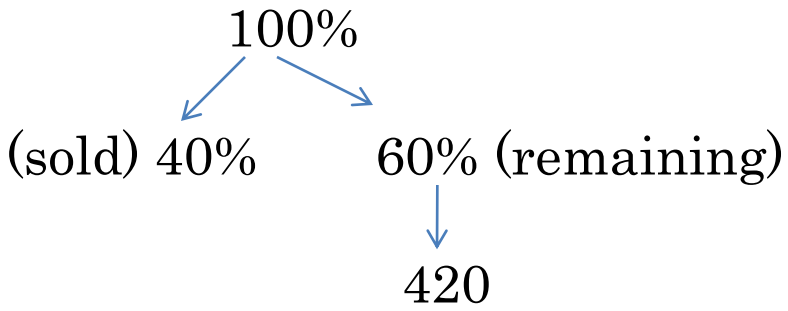
b% of 30 = 30% of b
= 30% of (30% of a)

10% of (30% of a) = 3% of a
30% = 9% of a

Q.3 A fruit seller had some oranges. He sells 40% oranges and still has 420 oranges. How many oranges he had originally?

A.280
B. 630
C.700
D. 1050

Solution:



∴ 60% = 420 oranges
No of oranges he had = 100% = ?

60% = 420
10% = 70

Q.4 An agent, gets a commission of 2.5% on the sales of cloth. If on a certain day, he gets Rs. 12.50 as commission, the cloth sold through him on that day is worth

A. 250
B. 500
C. 750
D. 1000

Solution:

Equate percentage value with the price to get the answer

Percentage commission = 2.5%
Commission in Rs = Rs 12.50

∴ 2.5% = Rs 12.50
5% = Rs 25
1% = Rs 5
100% = Rs 500

Q.5 A student has to obtain 33% of the total marks to pass. He got 125 marks and failed by 40 marks. The maximum marks are-

A. 400
B. 500
C. 600
D. 800

Solution:
Equate percentage value with the marks to get the answer

Percentage Pass mark = 33%
He got 125 marks and need 40 more marks to pass
∴ **Pass mark** = 125 + 40 = **165**

33% = 165
Maximum marks = 100%

33% = 165
1% = 5
100% = 500

Q.6 In a test A got 15% of the marks and failed by 7 marks whereas B got 28% and got 32 marks more than the pass mark. What was the pass mark?

A. 45
B. 52
C. 84
D. 300

Solution:

Equate percentage value with the price to get the answer

Percentage of A = 15%
Marks of A = -7 (Deviation from pass mark)

Percentage of B = 28%
Marks of B = + 32

Percentage difference b/w A and B = 13%
Marks difference b/w A and B = 39

$\therefore$ 13% = 39 marks
1% = 3 marks

Now either find 15% and add +7 to get the pass mark or find 28% and subtract 32 to get the pass mark

1% = 3 marks
15% = 45 marks
15% + 7 = 52 marks

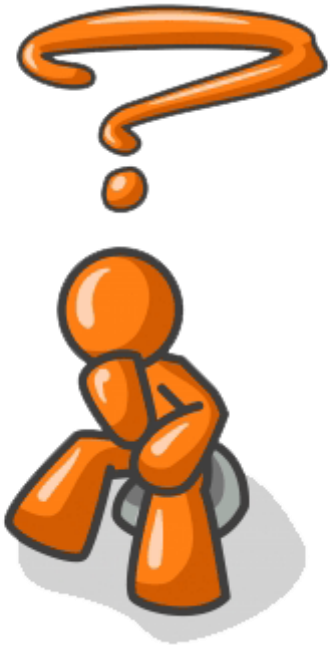
Or

1% = 3 marks
28% = 84 marks
28% - 32 = 52 marks

5) Practice problems

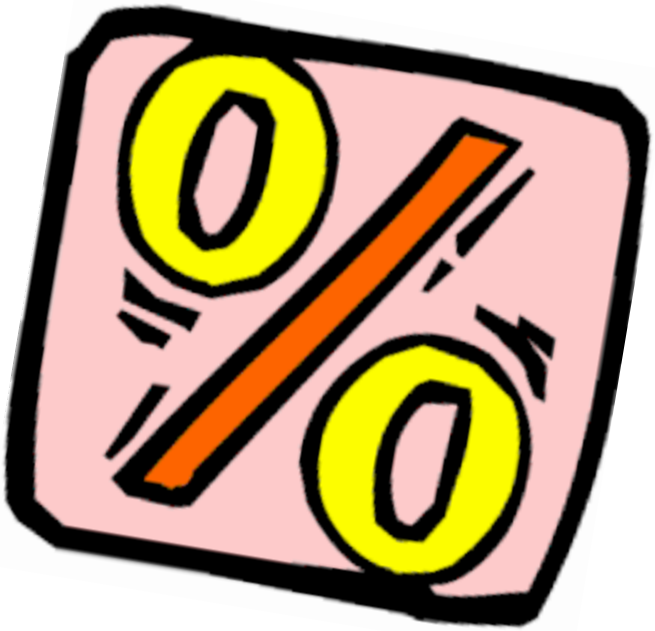
Q.1 What percentage of numbers from 1 to 70 have 1 or 9 in the unit's digit?

A. 1
B. 20
C. 14
D. 21



Q.2 45 x ? = 25% of 900

A. 4
B. 5.2
C. 16
D. 5



Q.3 One fourth of one third of two fifth of a number is 15. What will be 40% of that number?

A. 180
B. 360
C. 90
D. 270

Q.4 If 15% of 40 is greater than 25% of a number by 2. Find the number.

A. 14
B. 18
C. 16
D. 20

Q.5 A student multiplied a number by 3/5 instead of 5/3 What is the percentage error in the calculation?

A. 34%
B. 44%
C. 54 %
D. 64%

Q.6 The value of a machine depreciates at the rate of 10% per annum. If its present value is Rs 162000. What was the value of the machine 2 years ago?

A) 220000
B) 200000
C) 240000
D) 210000

Q.7 Two numbers A and B are such that the sum of 5% of A and 4% of B is two-third of the sum of 6% of A and 8% of B. Find the ratio of A : B.

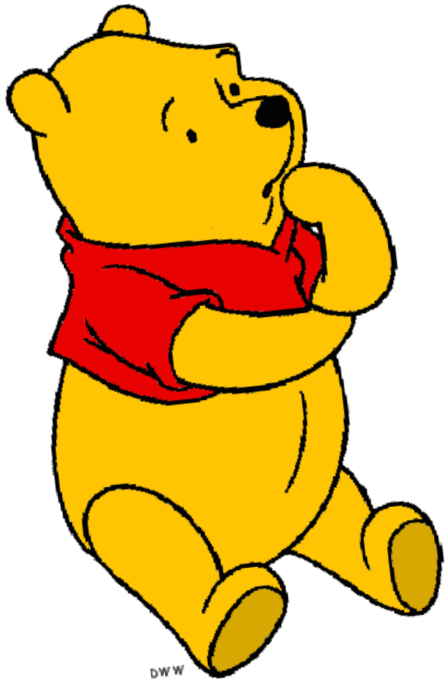
A. 2:1
B. 3:4
C. 4:3
D. 1:2

Q.8 An inspector rejects 0.08% of the meters as defective. How many meters he has to examine to reject 2 meters?

A. 2500
B. 1900
C. 1200
D. 2400

Q.9 1100 boys and 700 girls are examined in a test; 42% of the boys and 30% of the girls pass. What is the percentage of the total who failed the exam?

A) 58
B) 62*(2/3)
C) 64
D) 67



Q.10 Three candidates contested an election and received 1136, 7636 and 11628 votes respectively. What percentage of the total votes did the winning candidate get?

A. 56%
B. 58%
C. 57%
D. 59%

THANKS
FOR
LISTENING