PERCENTAGES

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Introduction

- What is percentage?

  In mathematics, a **percentage** is a number or ratio expressed as a fraction of 100..

- Why percentage?

  It helps in comparison by making the same base value for every comparison.

Basic Question Types

- Almost all the questions which come from Percentages can be broadly classified into 4 categories-

If A=50 and B=40, then

Q1. A is what percent of B?

Q2. B is what percent of A?

Q3. A is what percent more than B?

Q4. B is what percent less than A?

Solution

$$\frac{\text{What we compare}}{\text{to whom/which value we compare}} \times 100$$

1. A/B × 100 ---------- 125%
2. B/A × 100 ---------- 80%
3. (A-B)/B × 100 ---------- 25%
4. (A-B)/A × 100 ---------- 20%

Shortcuts

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

Shortcut 2:

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%.....
-

Shortcut 3:

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

No

<u>a% of b can be written as b% of a</u>
Proof: a% of b = b% of a
a/100 x b = b/100 x a
ab/100 = ab/100

$\therefore$ 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

Percentage Change

- **PERCENTAGE INCREASE and PERCENTAGE DECREASE**

EXAMPLE- Lets say you have a factory which produced 20 cars in Year 1 and 25 cars in Year 2.

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 decrease = 5/25 * 100

= 1/5 * 100

= 20%

Example: Sachin makes $5M a week from his job. He earns a raise and now makes $6M a week. What is the percent increase?

A. 16.66%

B. 20%

C. 25%

D. 50%

Solution: Percentage increase = (1/5) * 100

= 20%

Successive Percentage Change

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 + 25% of x = 1.25x

Speed of the car after 2nd increase = 1.25x + 20% of 1.25x = 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 = 100+25=125

Speed of the car after the 2nd increase = 125+2(12.5)= 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%,** then 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 net percentage change city's population at the end of 2010?

Solution:

$$25 + (-8) + (25)(-8)/100\ \%$$

$$= 25 - 8 - 200/100\ \%$$

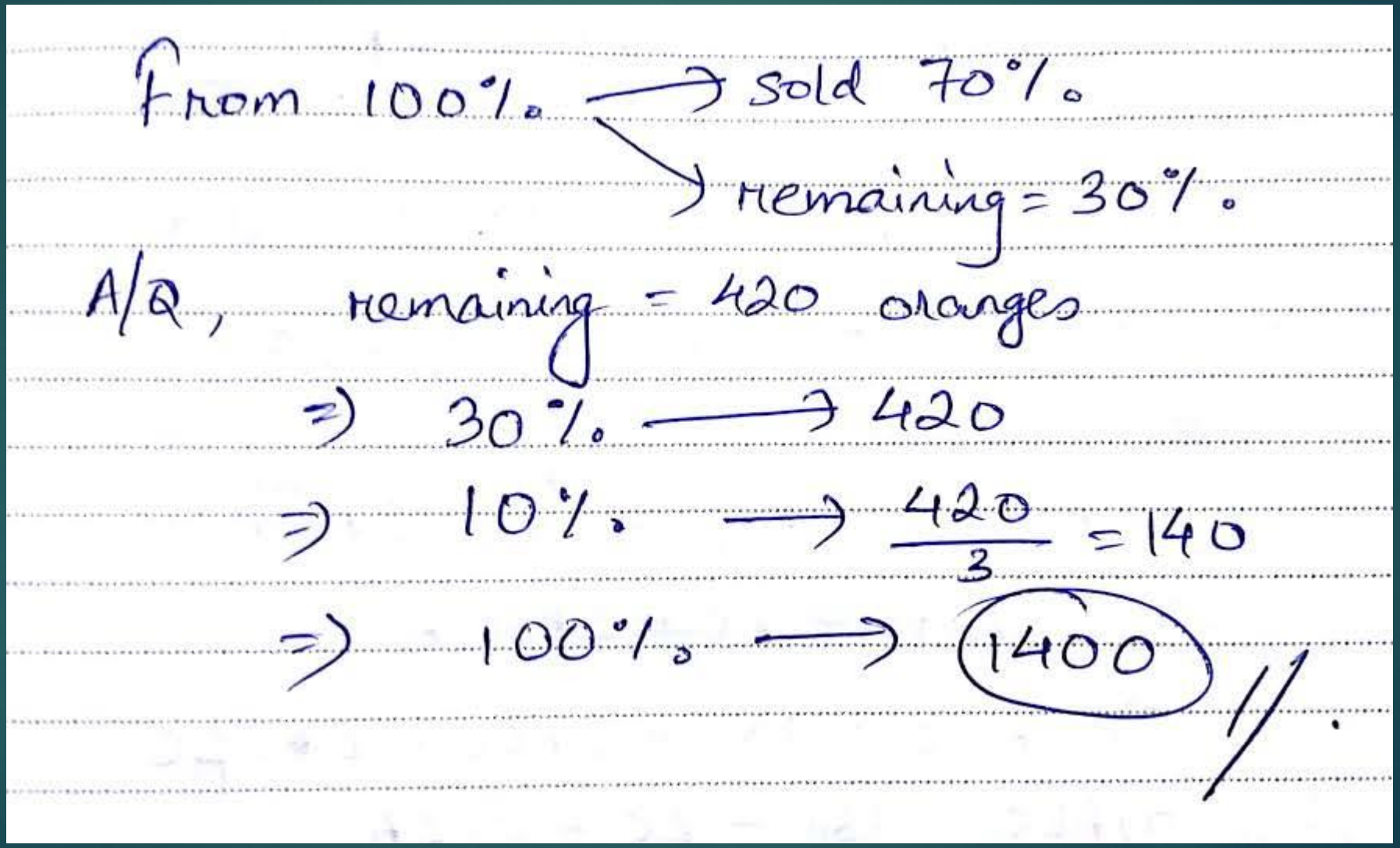
$$= 25 - 8 - 2\ \%$$

$$= 15\ \%$$

Question: A fruit seller had some oranges. He sells 70% oranges and still has 420 oranges. How many oranges he had originally?

A. 1400
B. 630
C. 700
D. 1050

- **Solution**


From 100%. → Sold 70%.
→ remaining = 30%.
A/Q, remaining = 420 oranges
⇒ 30% → 420
⇒ 10% → 420/3 = 140
⇒ 100% → 1400
//.

Question: An agent, gets a commission of 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. 125
B. 250
C. 500
D. 1000

Solution

Percent commission = 5 %, Actual commission = Rs 12.5

∴ 5% of sales ⟶ Rs 12.5

10% of sales ⟶ Rs 25

100% ⟶ Rs 250.

Question:- 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% ------→ 165/33= 5

100% = 500

Q. 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

∴ 13% = 39 marks

1% = 3 marks