PERCENTAGES

Averages
Ratio
TSD
TW
SI-CI
Data Interpretation

Content

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- Percentage change
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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.

15 out of 50

$\rightarrow \frac{15}{50} \times 100 = 30\%$.

55 out of 200

$\frac{55}{200} \times 100 = 27.5\%$

Shortcuts

Shortcut 1: Splitting of values

a) 20% of 80 = ?

100% of 80 = 80

÷10 → 10% of 80 = 8 ← ÷10

20% of 80 = 16

↓

2 x 8

20% of x = 2 x 10% of x

Q. Try 30% of 60

A. 15
B. 18
C. 21
D. None of these

10% → 6

30% → 3 × 10%

= 3 × 6 = 18

Q) 30% of 62 =

10% → 6.2

30% → 3 × 6.2

= 3 × [6 + 0.2] = 18.6

18 0.6

b) 15% of 80 = ?

10% of 80 = 8

÷2 → 5% of 80 = 4 ← ÷2

15% of 80 = 12

8 + 4

15% → 10% + 5%

Q. Try 15% of 60

A. 6
B. 7
C. 8
D. 9

10% → 6
5% → 3
15% → 9

Q) 15% of 62 →

10% = 6.2
5% = 3.1
15% = 9.3

12 → 10 + 2

12% → 10% + 2% | 20% − 8%

To find 2%

2 × 1%

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

10% + 3 × 1%

↓ 6

↓ 3 × 0.6 = 1.8

a. 7.7

b. 7.8

c. 9.1

d. None

Q) 11.2% of 60

→ 10% + 1% + 0.2%

→ 6 + 0.6 + 0.12

→ 6.72

0.2% → 2 × 0.1%

→ 2 × 0.06

→ 0.12

Q) 11.2% of 62

→ 10% + 1% + 0.2%

→ 6.2 0.62 0.124

→ 6.944

45% → 50% − 5%
45% → 40% + 5%

d) 45% of 80 = ?

50% of 80 = 40 (÷10)

5% of 80 = 4 (÷10)

45% of 80 = 36 [40 − 4]

55% of 80
↓
50% + 5%
↓
40 + 4 = 44

66% of 80
↓
60% + 6%
↓ ↓
48 + 4.8
= 48 + [4 + 0.8]
= 52.8

Try 45% of 60

A. **60**

B. **30**

C. **36**

D. ~~24~~ 27

Shortcut 2: Remembering some Ratio for %

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 = ?

25% of 64 = $\frac{1}{4} \times 64$
= 16.

12.5% of 80 = ?

1 = 100%
1/2 = 50%
1/4 = 25%
1/8 = 12.5%

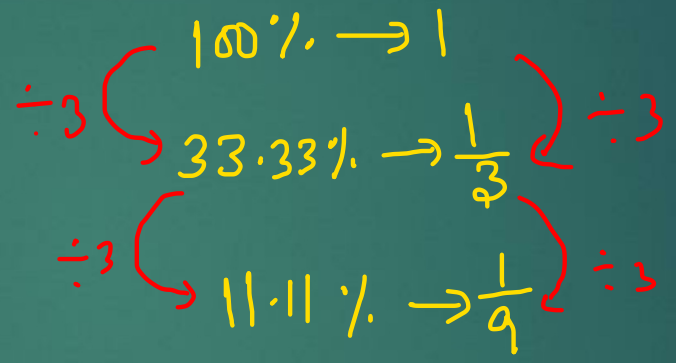
÷2 ÷2 ÷2 ÷2 ÷2

∴ 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

a% of b can be written as b% of a- **YES or 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

$\therefore$ 62% of 150 = 150% of 62

= (100% + 50%) of 62

= 62 + 31

= 93 ✓

150% → 100% + 50%

↓ ↓

62 31

→ 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.

Q) 8.8% of 12.5 = 12.5% of 8.8

$= \frac{1}{8} \times 8.8 = 1.1$

Q. **Try 84% of 250**

a. 168
b. 200
c. 210
d. 250

250% of 84

250% = 2 × 100% + 50%

250% of 84 = 25% of 840

$= \frac{1}{4} \times 840$

$= 210$

Q. Try 72% of 90

A. 63
B. 64.8
C. 65.2
D. None

90% of 72

$9 \times 10\%$

$= 9 \times 7.2$

$= 9 \times [7 + 0.2]$

$= 9 \times 7 + 9 \times 0.2$

$= 63 + 1.8 = 64.8$

100% - 10%

72 - 7.2

$= 72 - [7 + 0.2]$

$= (72 - 7) - 0.2$

$= 64.8$

Percentage Change = $\frac{\text{Actual change}}{\text{Initial value}} \times 100$

- **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?

A. 17%
B. 15%
C. 33%
D. None of these

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

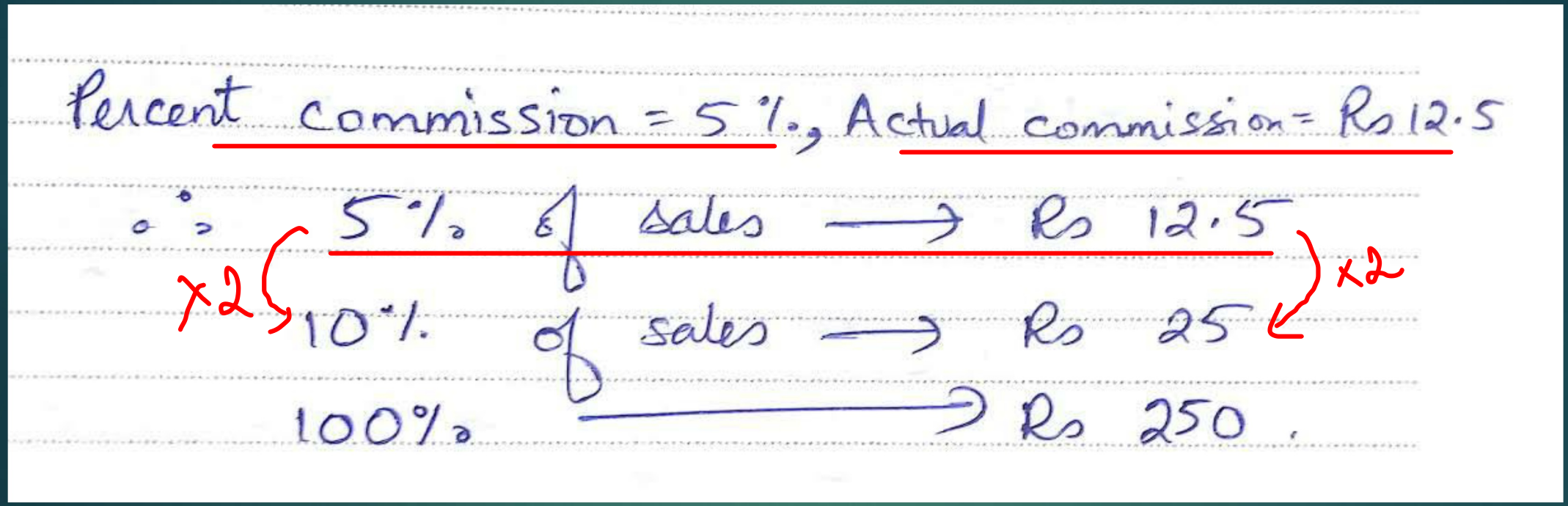
⇒ 10% → $\frac{420}{3} = 140$

⇒ 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
×2
10% of sales ⟶ Rs 25
×2
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

÷33 ↓

1% ------→ 165/33=5

100% = 500

165 / 33 = 5

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

Q. A is x% less than B, A is y% less than C. C is k% more than B. Express k in terms of x and y.

A $\frac{(y-x)100}{100-y}$

B $\frac{(y+x)100}{100-y}$

C $\frac{(y-x)100}{100-x}$

D $\frac{(y-x)100}{100+y}$

- Option A

Q. In a class 20% of students are below 14 years of age. Out of the remaining students 10% are of the age 14-15 years and ratio of students who are between 15-16 years of age to student above 16 years of age is 3:2. If the number of students who are above 16 years is 72, what is the total number of students in the class?

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A 200 B 250 C 300 D 400

Answer Key

- Option B

THANK YOU