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Aptitude Advanced

# Calculations & Approximations

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## Chapter 1: Approximation

This is an important part of almost all competitive exams these days. You should have a sufficient practice of these questions. Otherwise, it consumes a lot of time in real time. There are various tricks to solve questions based on approximation like solving the mixed fractions by breaking into two parts, i.e. whole number and a fraction part, taking a nearest perfect square and perfect cube etc. Let us first learn about the approximations.

An approximation is anything that is close, but not exactly equal to something else. It is an important technique, which helps a candidate to find the solution quickly in competitive exams by rounding off to the nearest integer, rather than solving the exact values.

You can understand this technique better with the help of the following examples.

**Ex.1.** Find the approximate value of $(13.001)^3$

a.1900 b. 2200 c.2000 d.1800

**Sol**: 3.001 is approximately equal to 13. So, instead of finding the cube of 13.001, we can simply find the cube of 13 and tick the answer nearest to that value. Now, a cube of 13 is 2197 and in options, we have 2200, which is nearest to 2197, so the correct answer is the second option.

***NOTE:*** *Always check the options; if the gap between the options is quite significant then approximation can be done even if it is not mentioned in the question.*

**Ex.2**. What should replace the question mark in the following equation?

$55.003 \times 54.998 + 5.001 = ?$

a.3500 b.3630 c.2540 d.3030

**Sol:** 55.003 and 54.998 both are approximately equal to 55. At the same time,5.003 is close to 5.

So, the equation reduces to the form $55 \times 55 + 5 = 3025 + 5 = 3030$. Besides, this question can also be solved by the algebraic formula. As you can write $55 \times 55 + 5 = (50+5) \times (50+5) + 5$.

$\Rightarrow (50+5)^2 + 5 = (50^2 + 5^2 + 2 \times 5 \times 50) + 5 = (2500 + 25 + 500) + 5 = 3025+5= 3030$.

**Ex.3.** What will 50.001% of 99.99 ÷ 49.999 be equal to?

a.1 b.0.1 c.0.01 d.0.02

**Sol:** 50.001 is approximately equal to 50.

99.99 can be written as equivalent to 100 and 49.99 is equivalent to 50.So the equation now becomes 50% of 100 ÷ 50 =?

50% of 100 is 50 and 50 divided by 50 gives us the answer 1.

**Ex.4**. 999.001 + 899.99 –349.88 =?

a.1549 b.1560 c.1449 d.1460

**Sol**: Approximating the above equation, we get, 1000 + 900 – 350 =1550.Option a is nearest to our answer. So, the correct answer is 1549.

**Ex. 5.** 119% of 1190 + 33% of 125 – 97 % of 813 =

a.620 b.700 c.725 d.681

**Sol:** To find 119% of 1190

(100 + 19)% of 1190⇒100 % of 1190 + 20 % of 1190. 1190 + 238 = 1428

33 % of 125 (33% is equivalent to one-third)⇒ 125 × 1/3 = 42 approximately.

97% of 813 = (100% - 3%) of 813 = 813 – 24 = 789.Now, the final solution will be 1428 + 42 -789 = 1470 – 789 = 681

Answer nearest to our value is option d.

## Chapter 2: Simplification

***Let us now discuss the simplification rules (BODMAS) that is an integral part of this concept.***

Simplification means to simplify a complicated mathematical expression to get a single answer. To understand it more clearly let us solve the following example.

**Example.** Solve 8 + 4 ÷ 2

**Sol:** The correct solution is as follows $= 8 + 4 \times \frac{1}{2}$ = 8 + 2 =10

**Note:** Many students will solve it as follows: 8 + 4 ÷ 2 = 12 ÷ 2 = 6 which is wrong. We must follow the rule of BODMAS.

According to the rule, multiplication should be done after division.

| **Rule of BODMAS** | |
|---|---|
| B = | Bracket (Brackets are solved in order of (, {, [. ) |
| O = | Of |
| D = | Division |
| M = | Multiplication |
| A = | Addition |

| | |
|---|---|
| S = | Subtractions |

So it means that while solving we must follow the above sequence. So in the above-given example we first divide 4 by 2 and add it to 8 as division (D) is before addition (A) in BODMAS.

## Chapter 3: Solved Examples

Now we will solve a few examples:

**Ex.1.** $5 + 5 \times 5 \div 5$

**Sol:** $5 + 5 \times 5 \times \frac{1}{5} \Rightarrow 5 + 5 = 10$

**Ex.2.** $2 + 2 \text{ of } 4 \div 2 - \frac{17}{4}$

**Sol:** $2 + 8 \div 2 - \frac{17}{4}$ (Note 'of' must be solved before ÷)

$$= 2 + 8 \times \frac{1}{2} - \frac{17}{4} \Rightarrow 2 + 4 - \frac{17}{4} \Rightarrow \frac{6}{1} - \frac{17}{4} \Rightarrow \frac{24-17}{4} = \frac{7}{4}$$

**Ex.3.** $15 - [3 - \{2 - (5 - \overline{6+3})\}]$

**Sol:** This is an example where brackets are given. Brackets are solved after Bar. The order of solving the brackets is () {} and []. So the solution of above examples is as follows.

$= 15 - [3 - \{2 - (5 - 9)\}] \Rightarrow 15 - [3 - \{2 - (-4)\}]$

$= 15 - [3 - \{2 + 4\}] \Rightarrow 15 - [3 - 6] \Rightarrow 15 - [-3] = 15 + 3 = 18$

**Ex.4.** Solve $\frac{5+5\times5\div5}{5\times5\div5+5}$

**Sol:** $\frac{5+5\times5\div5}{5\times5\div5+5}=\frac{5+5\times5\times\frac{1}{5}}{5\times5\times\frac{1}{5}+5}=\frac{5+5}{5+5}=\frac{10}{10}=1$

**Ex. 5.** Solve $\frac{5\div5 \text{ of } 5+5}{5\div5\times5+5}$

**Sol:** $\frac{5\div5 \text{ of } 5+5}{5\div5\times5+5}\Rightarrow\frac{5\div25+5}{5\times\frac{1}{5}\times5+5}=\frac{5\times\frac{1}{25}+5}{5+5}=\frac{\frac{1}{5}+5}{10}\Rightarrow\frac{26}{5}\times\frac{1}{10}=\frac{13}{25}$

**Ex.6.** Solve 8.07× 41.09 +? = 400.37

**Sol.** In this question we do not need to solve with the actual values. We can take the approximate values. We have 8.07× 41.09 +? = 400.37 which can be rewritten as 8 × 41 + x = 400 => 328 + x = 400 => x = 72. So the answer should be close to 72.

**Ex.7.** What approximate value will come (?) in the following equation?
$17.03^2+\sqrt{121.009}\times43$ =?

**Sol.** In this question we can take the approximate values as $17^2 + \sqrt{121} \times 43 = 289 + 11 \times 43 = 762$. So the answer should be close to 762.

**Ex.8.** Solve 1.5% of 1350 – 1.25% of 800 = ?

**Sol.** We have 1.5% of 1350 – 1.25% of 800 = x
=> x = 20.25 – 10 = 10.25.

**Ex.9.** What approximate value will come (?) in the following equation?
9485.23 + 6432.14 - ? = 8122.12

**Sol.** We have 9485.23 + 6432.14 - x = 8122.12
=> 9485 + 6432 – x = 8122 => x = 7795.

**Ex.10.** What approximate value will come (?) in the following equation?
1985.59 - ? = 1807.88 – 951.46

**Sol.** 1985.59 - x = 1807.88 – 951.46
=> 1985 – x = 1807 – 951
=> x = 1129.

**Ex. 11.** 59% of 630 + 23% of 310 = ?

**Sol.** Here 59% of 630 + 23% of 310 = x,
Taking approximate values we have x = 371 + 71 = 442.

**Ex.12.** What approximate value will come (?) in the following equation?
89.8% of 745 + 74.5% of 898 = ?

**Sol.** We have 89.8% of 745 + 74.5% of 898 = x. Taking approximate values we can write it as 90% of 745 + 75% of 898 = 670 + 673 = 1343. Hence answer is 1343.

**Ex.13.** 452% of 87.5 + 31.11% of 790 =?

**Sol.** We have 452% of 87.5 + 31.11% of 790 = x
=> x = 395 + 246 = 641. Hence answer is 641.

**Ex. 14.** Find the approximate answer : 291 × 39 + 337 × 41 = ?

**Sol.** We have 291 × 39 + 337 × 41 = x. Taking approximate values we get x = 290 × 40 + 340 × 40 = 11600 + 13600 => x = 25200. So answer is 25200.

**Ex.15.** What approximate value will come (?) in the following equation?
84.95% of 280 + √? = 253.001

**Sol.** 253.001=253, 84.95% of 280 + $\sqrt{?}$ =253
Hence ? = 225