Simplification Short Tricks

Simplification and Approximation forms an important part of all Banking exams as 3-5 questions are expected from this chapter alone. In Simplification, we have to simplify & calculate the given expressions whereas, in Approximation, we take the approximate values & give the answers accordingly.

Basic Rules of Simplification

BODMAS Rule

It defines the correct sequence in which operations are to be performed in a given mathematical expression to find the correct value. This means that to simplify an expression, the following order must be followed -

***B** = Bracket,*
***O** = Order (Powers, Square Roots, etc.)*
***D** = Division*
***M** = Multiplication*
***A** = Addition*
***S** = Subtraction*

1. *Hence, to solve simplification questions correctly, you must apply the operations of brackets first. Further, in solving for brackets, the order - (), {} and [] - should be stricly followed.*
2. *Next you should evaluate exponents (for instance powers, roots etc.)*
3. *Next, you should perform division and multiplication, working from left to right. (division and multiplication rank equally and are done left to right).*
4. *Finally, you should perform addition and subtraction, working from left to right. (addition and subtraction rank equally and are done left to right).*

EXAMPLE 1: Solve 12 + 22 ÷ 11 × (18 ÷ 3)^2 - 10
= 12 + 22 ÷ 11 × 6^2 - 10 (Brackets first)
= 12 + 22 ÷ 11 × 36 - 10 (Exponents)
= 12 + 2 × 36 - 10 = 12 + 72 - 10 (Division and multiplication, left to right)
= 84 - 10 = 74 (Addition and Subtraction, left to right)

EXAMPLE 2: Solve 4 + 10 - 3 × 6 / 3 + 4
= 4 + 10 - 18/3 + 4 = 4 + 10 - 6 + 4 (Division and multiplication, left to right)

*= 14 - 6 + 4 = 8 + 4 = 12 (*Addition and Subtraction, left to right)

To Solve Modulus of a Real Number

The Modulus (or the absolute value) of x is always either positive or zero, but never negative. For any real number x, the absolute value or modulus of x is denoted by |x| and is defined as |x|= x {if x ≥ 0} and −x {if x < 0}

EXAMPLE 1: Solve |8|

|8| = |-8| = 8

Tips to Crack Approximation

Conversion of decimal numbers to nearest number

To solve such questions, first convert the decimal to nearest value. Then simplify the given equation using the new values that you have obtained.

EXAMPLE 1: Solve 4433.764 - 2211.993 - 1133.667 + 3377.442

Here,

4433.764 = 4434

2211.993 = 2212

1133.667 = 1134

3377.442 = 3377

Now simplify, 4434 - 2212 - 1134 + 3377 = 4466

EXAMPLE 2: Solve 530 x 20.3% + 225 x 16.8%

Here, 20.3% becomes 20% and 16.8% becomes 17%

Now, simplify 530 x 20% + 225 x 17%

= 106 + 38.25 = 144.25

Approximation of Square Roots

1. *To simplify a square root, you can follow these steps:*
2. *Factor the number inside the square root sign.*
3. *If a factor appears twice, cross out both and write the factor one time to the left of the square root sign. If the factor appears three times, cross out two of the factors and write the factor outside the sign, and leave the third factor inside the sign. Note: If a factor appears 4, 6, 8, etc. times, this counts as 2, 3, and 4 pairs, respectively.*
4. *Multiply the numbers outside the sign.*
5. *Multiply the numbers left inside the sign.*
6. *To simplify the square root of a fraction, simplify the numerator and simplify the denominator.*

Now we are going to share some important tips and tricks that will help you prepare the Simplification - Approximation topic better.

Simplification / Approximation: Tips and Tricks

We strictly recommend you to learn square (up to 30) and cube (up to 20).We will discuss here methods to solve and types of problems which are generally asked in exams.

Unit Digits and its applications

Ex: 298: 8 is the unit place in 298.

Ex: 1947: 7 is the unit place in 1847.

Ex: 2345×6789
(A)15920206 (B)15920208 (C) 15920205 (D) 15920204
Solution: When unit place of 5 in 2345 and unit place of 9 in 6789 multiplies we will get 45. So when both numbers are multiplies it should have 5 at its unit place which is only in option C.
Ex: 43 × 36 + 57 × 89
(A)6380 (B)5728 (C)6782 (D)6621
The unit digit will be the sum of the individual unit digits.
(3×6)+(7×9) = 18+63 = 81
So the resultant number must have 1 at its unit place.

Digit Sum

It is the sum of all digits of the number used in making the number and keep adding till we have only one digit left.
Ex: 2345
Digit sum = (2+3+4+5) = 14 = 1+4 = 5
Ex: 123456789
Digit sum = (1+2+3+4+5+6+7+8+9) = 45 = (4+5) = 9
Note: In this case our assumption is that 9 should be treated as 0.
Ex: 123 × 456 × 781
(A)43804728 (B) 53804728 (C) 53804528 (D)33804958
LHS (Digit sum)= (1+2+3)×(4+5+6)×(7+8+1)= 6× 6× 7 = 36× 7 = 9 × 7 = 63 = 0

RHS (Digit sum):
(A) (4+3+8+0+4+7+2+8)= 36 =(3+6)= 9 = 0
(B) (5+3+8+0+4+7+2+8) = 37 = 10 = (1+0) = 1
(C) = 35 = (3+5) = 8
(D) =31 = (3+1) = 4
So, Option A is the answer.
Ex: 2011×97+50123 = ? × 743
(A) 340 (B) 330 (C) 350 (D) 303 (E) 345
Solution:
In LHS 2011×97, unit digit will be 7
In 50123, the unit digit is 3, So when we add these, the addition will have '0' at its unit place.
In RHS, we also need '0' at the unit place, the number which has to multiplied by 743 must consist 0 at its unit place. So, option (D) and (E) are eliminated.
Now Let's apply Unit digit and digit sum
In LHS, 2011×97+ 50123
4 × 7 + 11 = 28+11 = 10+2 = 1+2 = 3
In RHS if option is (A)
then 340 × 743 = 7×14 = 7 × 5 = 35 = 8
LHS ≠ RHS
In RHS if option is (B)
then 330 × 743 = 6× 14 = 6× 5 = 30 = 3
LHS = RHS, It is the answer. If you check other options it will not satisfy this.
Ex: 6269+0.75× 4444+0.8×185 =?
(A)9759 (B)9750 (C)9740 (D)9755 (E)9655

Solution:
6269+ (3/4)×4444+148.0
6269+3333+148

We can see that unit digit is Zero. So options remained are B and C.

Now, (23)+(12)+(13)

5+3+4 = 12 = 3

Applying digit sum for (C) = 2 and (B) = 3

So, answer is B

How to calculate Square Root?

Perfect Square

If the square ends in	***1***	***4***	***5***	***6***	***9***	***0***
The number would end in	*1,9*	*2,8*	*5*	*4,6*	*3,7*	*0*

When a number is given, split it in two parts, in such a way that 2nd part has last two digits of number and first part will have remaining digits.

Ex 1: Square root of 3481
Split number in two parts i.e. 34 and 81(last two digits)
We know that square of number ends in 1, so square root ends either in 1 or 9.
Check, 34 lies between 25 (square of 5) and 36 (square of 36). Take smaller number.
So, our answer is either 51 or 59.
but we know 502 = 2500 and 602 = 3600, 3481 is nearest to 3600. So the answer is 59.
or 34 is more close to 36 than 25, so the answer is 59.
Ex 2: 76176
Split: 761 76
Number will end in either 4 or 6,
729(272) < 761 < 784 (282), So the answer may be 274 or 276. 761 is more close to 784, so the answer is 276.
Ex 3: square root of 75076
Split: 750 76
Number will end in either 4 or 6
729(272) < 750 < 784 (282), So the answer may be 274 or 276. 750 is more close to 729 than 784, so the answer is 274.
Non-Perfect Square: This gives approximate value not an exact value.
Ex4: 1000
961(312) < 1000 < 1024(322)
Now, 1000 is nearest to 1024
So, 32 – ((1024-1000)/(2× 32))

32 – (24/64)

32-.375 = 31.625

or 31+((1000-961)/(2× 31))

31 + (39/62)

31+.629 ≈ 31.63

How to calculate Cube root?

If the cube ends in	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*0*
The number would end in	*1*	*8*	*7*	*4*	*5*	*6*	*3*	*2*	*9*	*0*

When a number is given, split it in two parts, in such a way that 2nd part has last three digits of number and first part will have remaining digits.
Ex 1: cube root of 3112136
Split in two parts 3112 136
Number will end with 6
143 (2744) < 3112 < 153 (3375)
Choose the smaller number and answer will be 146.
Ex 2: cube root of 2406104
split in two parts 2406 104
Number will end with 4
133 (2197) < 2406 < 143(2744)
So the answer will be 134.

To approximate Actual values

If (and only if) we need to find the actual value of a given fraction, represent the numerator as sum or difference of terms related to denominator.

1449/132 =

1449 = 1320 + 132 – 3

1449/132 = 10 + 1 – a small value ≈ little less than 11 (actual value is 10.977)

36587 / 123 =

36587 = 36900 – 246 – 61.5 - ...

36587 / 123 = 300 – 2 - 0.5 – a small value ≈ little less than 297.5 (actual is 297.455)

1569 / 12 =

1569 = 1200 + 360 + 8.4 + 0.6

1569 / 12 = 100 + 30 + 0.7 + 0.05 = 130.75

To Approximate relative values

Most of the DI questions revolves around sorting the given numbers/fractions or finding its relative position (lesser/greater than) based on a reference value. If we don't need the actual value, DON'T find the actual value.

Find the largest and smallest value among the below fractions

56/298, 46/374, 138/493, 37/540, 670/2498

We will do the first level approximation by guesstimating the given fractions. Try to represent the given numbers in 1/x format. While arranging fractions we usually try to represent the given fractions with the same denominator after finding the LCM of all denominators. But we are here

to solve faster using approximation. We will take an easier route, Make the numerator same, i.e. one.

*56/298, we know 56 * 6 > 298 = > 56/298 > 1/6. Note that we didn't find the actual value of 56 * 6; we just want to get the closest multiple of 56 to the number 298.*

56/298 = Greater than 1/6

46/374= Less than 1/8

138/493 = Greater than 1/4

37/540 = Greater than 1/15

670/2498 = Greater than 1/4

We don't have any confusion in finding the smallest which is 37/540 (1/15 is less than other values). But we have 2 candidates fighting for the largest fraction title, 138/493 and 670/2498. We will consider only those two and try to get an approximate value. We will try both methods discussed before for finding the actual value.

Method 1:

138 = 98.6 + 24.65 + 12.325 + …

138/493 ≈ 0.2 + 0.05 + 0.025 + small value ≈ greater than 0.275

670 = 499.6 + 124.9 + 49.96 – 4.46

670/2498 ≈ 0.2 + 0.5 + 0.02 – small value ≈ less than 0.27

Hence 138/493 is the largest.

Method 2:

138/493,

We can see denominator is close to 3.5 times numerator. Hence if we increase denominator by x, we need to balance the fraction by increasing numerator by x/3.5. We will get an easier fraction if we can write denominator as 500 by adding 7. We also need to add 7/3.5 = 2 to the numerator.

138/493 ≈ 140/500 ≈ 0.28

Similarly for 670/2498, here we can get a neat fraction by adding 2 to the denominator. And here as 2 is negligible compared to the denominator we can very well skip the balancing part and write fraction as 670/2500 = 0.268

Hence, 138/493 is the largest.

Here we wrote 670/2500 = 0.268. How?

670/2500 = 67/250, we can get denominator as 1000 by multiplying both sides by 4. Hence 67/250 = 268/1000 = 0.268

We used the same logic while 'cleaning up' 140/500. Multiply both sides with 2 to get denominator as 1000. Fraction becomes 280/1000 = 0.028

Here, instead of finding actual values of all five fractions and comparing them we just played with the relative values of the fractions and found actual values only for two cases which were required to get the answer.

Another usual DI question type is to find the relative position of a given value based on a reference value. This question comes like 'How many students scored marks more than class average (Reference value)' , 'How many players has strike rate higher than Sachin (Reference value)' etc…

How many of the given values are greater than 0.7

11/13, 25/34, 33/46, 44/65, 56/81

As we are asked to find only the relative values (with respect to 0.7) don't jump into finding actual values. Take few seconds to write the below statement which will help us in solving faster.

If x/y > 0.7, x > 0.7 y, 10x > 7y

So we need to find all fractions where 10 times numerator is greater than 7 times y. multiplying both sides with 10 is to ease the calculation and simplify the comparison :)

Take fractions one by one

Three fractions (11/13, 25/34 and 33/46) are greater than 0.7

Most of us have higher comfortable level with multiplication than division. To find relative values based on a reference point, convert division into multiplication. This way we can get our answers faster without messing with our accuracy.

In our example 56/81 = 0.69, still we were able to find it is lesser than 0.7 without doing any complicated or time consuming stuff.

Simplification Tricks – Easiest way to choose simplification questions:

***STEP 1**: Know about BODMAS Rule. Following are the list of priority given for brackets and signs.*
***STEP 2**: If an expression Contains brackets, the expression within the **brackets** should be simplified first.*
***STEP 3**: If an expression contains '**Of**', multiplication, division, addition and subtraction, then **of** should be performed first then followed by multiplication or division.*
Proceeding from left to right, addition and subtraction are carried out in the order in which the sign of addition and subtraction are given.
*If expression contains **'Of' and Division – always do 'Of'** and then do division*

***STEP 4**: If expression involves all the **four operations**,**then multiplication and division**is carried out **first** in the order in which they are given from left to right. The same rules are carried out for addition and subtraction*

Learn squares and cubes of number (Simplification Tricks)

Simplification Tricks – Squares(1^2 to 30^2):

- $1^2 = 1$
- $2^2 = 4$
- $3^2 = 9$
- $4^2 = 16$
- $5^2 = 25$
- $6^2 = 36$
- $7^2 = 49$
- $8^2 = 64$
- $9^2 = 81$
- $10^2 = 100$
- $11^2 = 121$
- $12^2 = 144$
- $13^2 = 169$
- $14^2 = 196$
- $15^2 = 225$
- $16^2 = 256$
- $17^2 = 289$
- $18^2 = 324$
- $19^2 = 361$
- $20^2 = 400$
- $21^2 = 441$
- $22^2 = 484$
- $23^2 = 529$
- $24^2 = 576$
- $25^2 = 625$
- $26^2 = 676$
- $27^2 = 729$
- $28^2 = 784$
- $29^2 = 841$
- $30^2 = 900$

Simplification Tricks – Cubes (1^3 to 15^3):

- $1^3 = 1$
- $2^3 = 8$
- $3^3 = 27$
- $4^3 = 64$
- $5^3 = 125$
- $6^3 = 216$

- $7^3 – 343$
- $8^3 – 512$
- $9^3 – 729$
- $10^3 – 1000$
- $11^3 – 1331$
- $12^3 – 1728$
- $13^3 – 2197$
- $14^3 – 2744$
- $15^3 – 3375$

Example 1: 21^2 / 49 × 6

Solution:*From the above question if we know the square value of 21^2, then this question will be easily solved*

STEP 1:*$21^2 = 441$*

STEP 2:*$441/49 = 9$*

STEP 3:*$9 \times 6 = 54$*

STEP 4:*Hence the answer for above series is****54***

REMEMBER FREQUENTLY ASKED FRACTION VALUES (Simplification Tricks)

- *5% = 0.05*
- *6 ¼ % = 0.0625*
- *10% = 0.1*
- *12 ½ = 0.125*
- *16 × (2/3)% = 0.166*
- *20 % = 0.2*
- *25 % = 0.25*
- *33 × (1/3)% = 0.33*
- *40 % = 0.4*
- *50% = 0.5*
- *60% = 0.6*
- *66 × (2/3) =0.66*
- *75 %= 0.75*
- *80 %= 0.8*
- *90 % = 0.9*
- *100% = 1*
- *125 % = 1.25*
- *150% = 1.5*
- *200 % = 2*
- *250 % =2.5*

Example 2): 60% of 250 +25% of 600

STEP 1*: Know the values of 60% =0.6 and 25 % = 0.25*

STEP 2*: Now directly multiply 0.6×250 + 0.25×600*

STEP 3:*0.6×250= 150*

0.25×600=150

***STEP 4**: 150+ 150 = 300*
STEP 5:**Hence the answer for above series is**300
Example 3): Solve mixed fraction – Multiplication
EXAMPLE 3: 2×(3/5) × 8×(1/3) + 7 ½ × 2×(2/3)
***STEP 1:**2×(3/5) × 8×(1/3) = (13/5) × (25/3) = 65/3*
***STEP 2:** + 7 ½ ×2×(2/3)= 43/6 × 12/5 = 86/5*
***STEP 3:**65/3 + 86/5 = 38×(15/13)*
STEP 4:**hence the answer for above series is**38×(15/13)
Example 4): Solve Mixed Fraction addition
***Example 4:**19×(3/5) + 23×(2/3) – 24×(1/5)*
***STEP 1:**Take all the whole number outside the bracket i.e. 19+23 -24 = 18*
***STEP 2:**Add fractions within bracket 18×[(3/5) + (2/3) – (1/5)] = 18(16/15)*
STEP 3:** Hence the answer for above series is**18(16/15)
Example 5): $(?)^2$+18×12= 6^2×5×2
***STEP 1:**Multiply 18 × 12 = 216*
***STEP 2:**Square of 6 = 36*
***STEP 3:**Multiply 36 ×5×2= 360*
***STEP 4:**$(X)^2$ +216 = 360*
***STEP 5:**$(X)^2$ = 360-216 = 144*
***STEP 6:**Therefore X = 12*