RRB JE / DMS — Mathematics

Complete Topic-wise Notes & 100 Practice Questions

CEN 04/2026 | STAGE 1 (CBT)

Number System • BODMAS • Decimals • Fractions • LCM & HCF • Ratio & Proportion • Percentages • Mensuration • Time & Work • Time & Distance • SI & CI • Profit & Loss • Algebra • Geometry • Trigonometry • Elementary Statistics • Square Root • Age Calculations • Calendar & Clock • Pipes & Cistern

Prepared for Entri App — RRB JE/DMS Exam Preparation Series

Part A — Concept & Formula Notes (All 20 Topics)

1. Number System

- Natural (N), Whole (W), Integers (Z), Rational, Irrational, Real numbers — know the hierarchy.
- 1 is neither prime nor composite; 2 is the only even prime.
- Divisibility: by 3/9 → digit sum divisible; by 11 → (sum at odd places) − (sum at even places) = 0 or multiple of 11.

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Unit digit cyclicity: 2,3,7,8 → cycle of 4  |  4,9 → cycle of 2  |  0,1,5,6 → always same
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If N = a^p·b^q·c^r, Number of factors = (p+1)(q+1)(r+1)
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2. BODMAS

- Order: **B**rackets → **O**f → **D**ivision → **M**ultiplication → **A**ddition → **S**ubtraction.
- Brackets solved innermost first: ( ) → { } → [ ].
- "Of" is treated like multiplication but is solved before plain division/multiplication in mixed expressions.

3. Decimals

- Align decimal points before adding/subtracting.
- Multiplication: multiply as whole numbers, then place the decimal by counting total decimal places of both numbers.
- Division: convert the divisor to a whole number by shifting the decimal point equally in both dividend and divisor.

4. Fractions

- Types: Proper, Improper, Mixed, Like, Unlike, Equivalent.
- To compare, convert to a common denominator (LCM) or to decimals.

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a/b ÷ c/d = a/b × d/c   |   Mixed number to improper: (whole×denominator + numerator)/denominator
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5. LCM and HCF

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HCF × LCM = Product of the two numbers (for exactly two numbers)
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HCF of fractions = HCF(numerators) / LCM(denominators)  |  LCM of fractions = LCM(numerators) / HCF(denominators)
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- "Leaves remainder r in each case" → find LCM/HCF of (numbers − r).
- "Least number added to make divisible" → divisor − remainder.

6. Ratio and Proportion

- Ratio compares quantities of the same kind; Proportion states two ratios are equal (a:b :: c:d ⇒ ad = bc).
- To combine a:b and b:c into a:b:c, make the "b" term equal in both ratios (LCM method).

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Fourth proportional to a,b,c = (b×c)/a  |  Mean proportional between a,b = √(ab)
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7. Percentages

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x% of N = (x/100) × N   |   To convert fraction to %: multiply by 100
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Net % change (successive x%, y%) = x + y + (xy/100)  (use negative sign for decrease)
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% to reduce after increase of x% to restore original = [x / (100+x)] × 100
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8. Mensuration

Shape	Area	Perimeter / Other
Square	side²	4 × side
Rectangle	l × b	2(l+b)
Triangle	½ × base × height	Heron's: √[s(s-a)(s-b)(s-c)]
Circle	πr²	Circumference = 2πr
Rhombus	½ × d1 × d2	4 × side
Trapezium	½(a+b) × h	—

Solid	Volume	Curved/Total Surface Area
Cube	side³	TSA = 6 × side²

Cuboid	l×b×h	TSA = 2(lb+bh+hl)
Cylinder	πr²h	CSA = 2πrh, TSA = 2πr(r+h)
Cone	⅓πr²h	CSA = πrl (l = slant height)
Sphere	&frac43;πr³	SA = 4πr²

9. Time and Work

If A does work in x days, A's 1-day work = 1/x

Combined 1-day work of A & B = 1/x + 1/y ⇒ Time together = xy/(x+y)

Men × Days (÷ efficiency) = constant work ⇒ M1D1 = M2D2

10. Time and Distance

Speed = Distance/Time | km/h to m/s: ×5/18 | m/s to km/h: ×18/5

Same direction (relative speed) = S1−S2 | Opposite direction = S1+S2

Boats & Streams: Downstream = B+S, Upstream = B−S ⇒ B = ½(Down+Up), S = ½(Down−Up)

11. Simple & Compound Interest

SI = (P × R × T)/100

CI (annual) = $P(1 + R/100)^T - P$

For 2 years: CI − SI = $P(R/100)^2$

12. Profit and Loss

Profit% = (SP−CP)/CP × 100 | Loss% = (CP−SP)/CP × 100

SP = CP(1 ± %/100) | Discount% works on Marked Price (MP): SP = MP(1−d/100)

13. Algebra

$(a+b)^2 = a^2+2ab+b^2$ | $(a-b)^2 = a^2-2ab+b^2$ | $(a+b)^2-(a-b)^2 = 4ab$

$a^2-b^2 = (a+b)(a-b)$ | $a^3+b^3 = (a+b)(a^2-ab+b^2)$

If $x+1/x = k$, then $x^2+1/x^2 = k^2-2$

14. Geometry

- Sum of interior angles of a polygon = (n−2) × 180°; each exterior angle of a regular n-gon = 360°/n.
- Pythagoras theorem: hypotenuse² = base² + height² (right triangle).
- Angle subtended by a diameter on the circle = 90°; angles in the same segment are equal.

15. Trigonometry

θ	0°	30°	45°	60°	90°
sinθ	0	1/2	1/√2	√3/2	1
cosθ	1	√3/2	1/√2	1/2	0
tanθ	0	1/√3	1	√3	∞

$\sin^2\theta + \cos^2\theta = 1$ | $1+\tan^2\theta=\sec^2\theta$ | $1+\cot^2\theta=\operatorname{cosec}^2\theta$

16. Elementary Statistics

Mean = (Sum of observations)/(Number of observations)

Median: middle value (odd n); average of two middle values (even n) — data must be sorted

Mode = most frequently occurring value | Range = Highest − Lowest

17. Square Root

- Use prime factorization or long division method for finding square roots.
- To find the number to add/subtract to make a perfect square, locate the nearest perfect squares above and below.

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√(a/b) = √a/√b  |  Perfect squares 1–30: memorize 1² to 30² for speed
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18. Age Calculations

- Always assign variables to present ages and form linear equations from the given conditions ("x years ago", "x years hence").
- Ratio-based age problems: assume ages as multiples of a common variable (e.g., 3x, 4x).

19. Calendar & Clock

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Odd days: 1 ordinary year = 1 odd day; 1 leap year = 2 odd days (used to find day of the week)
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Angle between hands at H hr, M min = |(30×H) − (11/2)×M| degrees
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Hands coincide 22 times in 24 hours (not 24, since 12:00 overlap is shared)
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20. Pipes & Cistern

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Inlet pipe = positive rate (fills); Outlet/leak = negative rate (empties)
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Net rate = sum of individual rates (with sign) ⇒ Time to fill/empty = 1 / (net rate)
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Part B — Practice Question Paper (100 Questions)

RRB JE/DMS Mathematics — Practice Set

Questions: 100 | Topics: 20 | Pattern: RRB JE CBT-1 Objective Type

Answer key with topic-wise mapping given in Part C

Number System

Q1. Find the unit digit of 3^{57}.
(A) 1 (B) 3 (C) 7 (D) 9

Q2. Which of the following is a prime number?
(A) 51 (B) 91 (C) 97 (D) 111

Q3. Find the remainder when 2^{100} is divided by 7.
(A) 1 (B) 2 (C) 4 (D) 6

Q4. The sum of the first 20 natural numbers is:
(A) 190 (B) 200 (C) 210 (D) 220

Q5. How many prime numbers are there between 1 and 50?
(A) 13 (B) 14 (C) 15 (D) 16

BODMAS

Q6. Simplify: 12 + 8 ÷ 4 × 2 − 3
(A) 11 (B) 13 (C) 15 (D) 17

Q7. Simplify: 7 + [3 × {2 + (5 − 3)}]
(A) 17 (B) 19 (C) 21 (D) 23

Q8. Simplify: 25 − 5 of 3 + 2
(A) 10 (B) 12 (C) 14 (D) 16

Q9. Simplify: (36 ÷ 6) × (4 + 2) − 5
(A) 29 (B) 31 (C) 33 (D) 35

Q10. Simplify: 100 ÷ 10 × 5 − 20 ÷ 4
(A) 40 (B) 42 (C) 45 (D) 48

Decimals

Q11. Convert 0.375 into a fraction in simplest form.
(A) 3/8 (B) 3/7 (C) 5/8 (D) 1/3

Q12. Simplify: 3.5 + 2.75 − 1.25
(A) 4.5 (B) 5.0 (C) 5.5 (D) 6.0

Q13. Find the value of 0.04 × 0.02
(A) 0.008 (B) 0.0008 (C) 0.08 (D) 0.8

Q14. Divide 12.6 by 0.3
(A) 4.2 (B) 42 (C) 420 (D) 0.42

Q15. Which is the largest? 0.5, 0.505, 0.55, 0.055
(A) 0.5 (B) 0.505 (C) 0.55 (D) 0.055

Fractions

Q16. Simplify: 2/3 + 3/4
(A) 17/12 (B) 5/7 (C) 11/12 (D) 13/12

Q17. Which fraction is the greatest?
(A) 3/5 (B) 4/7 (C) 5/9 (D) 2/3

Q18. Simplify: (2/3) ÷ (4/9)
(A) 3/2 (B) 2/3 (C) 8/27 (D) 9/8

Q19. Find the value of 1½ × 2(2/3)
(A) 3 (B) 4 (C) 5 (D) 6

Q20. Simplify: 5/6 − 1/3 + 1/2
(A) 1/2 (B) 2/3 (C) 1 (D) 3/2

LCM and HCF

Q21. Find the HCF of 36 and 60.
(A) 6 (B) 12 (C) 18 (D) 24

Q22. Find the LCM of 12, 15 and 20.
(A) 60 (B) 120 (C) 180 (D) 240

Q23. HCF and LCM of two numbers are 6 and 90. If one number is 18, find the other.
(A) 24 (B) 27 (C) 30 (D) 36

Q24. Find the greatest number that divides 245 and 1029 leaving remainder 5 in each case.
(A) 8 (B) 16 (C) 32 (D) 64

Q25. Find the smallest number which when divided by 8, 12, 16 leaves remainder 3 in each case.
(A) 48 (B) 51 (C) 45 (D) 54

Ratio and Proportion

Q26. If a:b = 3:4 and b:c = 5:6, find a:b:c.
(A) 15:20:24 (B) 9:12:16 (C) 3:4:6 (D) 12:15:18

Q27. Divide ₹720 in the ratio 2:3:4. Find the largest share.
(A) 240 (B) 280 (C) 320 (D) 360

Q28. If x:y = 2:3, find (3x+2y):(2x+3y).
(A) 11:13 (B) 12:13 (C) 13:12 (D) 2:3

Q29. Find the fourth proportional to 4, 6, 10.
(A) 12 (B) 15 (C) 18 (D) 20

Q30. Two numbers are in the ratio 5:7. If their sum is 144, find the smaller number.
(A) 55 (B) 60 (C) 65 (D) 70

Percentages

Q31. What is 35% of 260?
(A) 81 (B) 91 (C) 101 (D) 111

Q32. If 20% of a number is 50, find the number.
(A) 200 (B) 225 (C) 250 (D) 275

Q33. A number is increased by 25% and then decreased by 20%. Find the net % change.
(A) No change (B) 5% increase (C) 5% decrease (D) 10% increase

Q34. The price of an item is increased by 25%. By what % should the new price be reduced to restore the original?
(A) 15% (B) 20% (C) 25% (D) 30%

Q35. 60% of 40% of a number is 48. Find the number.
(A) 150 (B) 180 (C) 200 (D) 220

Mensuration

Q36. Find the area of a rectangle with length 15 cm and breadth 8 cm.
(A) 100 cm² (B) 110 cm² (C) 120 cm² (D) 130 cm²

Q37. Find the circumference of a circle of radius 7 cm (π=22/7).
(A) 22 cm (B) 44 cm (C) 66 cm (D) 88 cm

Q38. Find the volume of a cube of side 6 cm.
(A) 196 cm³ (B) 206 cm³ (C) 216 cm³ (D) 226 cm³

Q39. Find the curved surface area of a cylinder with radius 7 cm, height 10 cm (π=22/7).
(A) 420 cm² (B) 440 cm² (C) 460 cm² (D) 480 cm²

Q40. Find the area of a triangle with base 12 cm and height 9 cm.
(A) 48 cm² (B) 54 cm² (C) 60 cm² (D) 66 cm²

Time and Work

Q41. A can do a work in 12 days and B in 15 days. In how many days will they finish it together?
(A) 6 days (B) 6⅔ days (C) 7 days (D) 7½ days

Q42. A does a work in 20 days; works 5 days and leaves. B finishes the rest in 9 days. In how many days can B alone finish it?
(A) 10 (B) 12 (C) 14 (D) 15

Q43. 12 men complete a work in 18 days. How many men are needed to finish it in 8 days?
(A) 24 (B) 27 (C) 30 (D) 32

Q44. A and B together finish a work in 8 days; A alone in 12 days. In how many days can B alone do it?
(A) 20 (B) 22 (C) 24 (D) 26

Q45. 6 women or 10 men can do a work in 15 days. In how many days can 12 women and 5 men do it?
(A) 5 (B) 6 (C) 7 (D) 8

Time and Distance

Q46. A train 150 m long crosses a pole in 10 seconds. Find its speed in km/h.
(A) 45 (B) 50 (C) 54 (D) 60

Q47. A car covers 300 km in 5 hours. Find its speed in m/s.
(A) 15 m/s (B) 16.67 m/s (C) 18 m/s (D) 20 m/s

Q48. Two trains 100 m and 150 m long run in opposite directions at 30 km/h and 20 km/h. Find the time to cross each other.
(A) 15 sec (B) 18 sec (C) 20 sec (D) 22 sec

Q49. A boat covers 24 km downstream in 3 hours and returns in 4 hours. Find the boat's speed in still water.
(A) 6 km/h (B) 7 km/h (C) 8 km/h (D) 9 km/h

Q50. A man walking at 5 km/h reaches office 10 min late; at 6 km/h he is 5 min early. Find the distance to office.
(A) 6 km (B) 7.5 km (C) 9 km (D) 10 km

Simple & Compound Interest

Q51. Find the SI on ₹5000 at 6% p.a. for 3 years.
(A) 800 (B) 900 (C) 1000 (D) 1100

Q52. Find the CI on ₹10,000 at 10% p.a. for 2 years (annual compounding).
(A) 2000 (B) 2050 (C) 2100 (D) 2200

Q53. A sum triples itself in 8 years at simple interest. Find the rate of interest.

(A) 20% (B) 25% (C) 30% (D) 33.33%

Q54. Find the difference between CI and SI on ₹8000 for 2 years at 5% p.a.
(A) 10 (B) 20 (C) 30 (D) 40

Q55. At what rate of SI will a sum double itself in 10 years?
(A) 8% (B) 10% (C) 12% (D) 15%

Profit and Loss

Q56. A man buys an article for ₹500 and sells it for ₹575. Find his profit %.
(A) 10% (B) 12% (C) 15% (D) 18%

Q57. A shopkeeper sells at a 10% loss; selling for ₹45 more would give a 5% gain. Find the cost price.
(A) ₹250 (B) ₹280 (C) ₹300 (D) ₹320

Q58. Find the SP of an article with CP ₹800 and profit 12.5%.
(A) ₹850 (B) ₹880 (C) ₹900 (D) ₹920

Q59. A trader marks goods 40% above CP and gives a 10% discount. Find his profit %.
(A) 20% (B) 24% (C) 26% (D) 30%

Q60. If the CP of 15 articles equals the SP of 12 articles, find the profit %.
(A) 20% (B) 25% (C) 30% (D) 35%

Algebra

Q61. Simplify: $(a+b)^2 - (a-b)^2$
(A) 2ab (B) 4ab (C) a^2+b^2 (D) $2a^2$

Q62. If $x + 1/x = 5$, find $x^2 + 1/x^2$.
(A) 21 (B) 23 (C) 25 (D) 27

Q63. Factorize: $x^2 - 9x + 20$
(A) $(x-4)(x-5)$ (B) $(x-2)(x-10)$ (C) $(x-1)(x-20)$ (D) $(x+4)(x+5)$

Q64. Solve for x: $3x - 7 = 2x + 5$
(A) 10 (B) 11 (C) 12 (D) 13

Q65. If $a+b=7$ and $ab=12$, find a^2+b^2.
(A) 23 (B) 25 (C) 27 (D) 29

Geometry

Q66. The sum of interior angles of a hexagon is:
(A) 540° (B) 630° (C) 720° (D) 900°

Q67. In a right triangle, the legs are 6 cm and 8 cm. Find the hypotenuse.
(A) 9 cm (B) 10 cm (C) 11 cm (D) 12 cm

Q68. The angles of a triangle are in the ratio 2:3:4. Find the largest angle.
(A) 70° (B) 75° (C) 80° (D) 90°

Q69. Find each exterior angle of a regular pentagon.
(A) 60° (B) 72° (C) 90° (D) 108°

Q70. The diagonals of a rhombus are 16 cm and 12 cm. Find its area.
(A) 88 cm^2 (B) 96 cm^2 (C) 104 cm^2 (D) 112 cm^2

Trigonometry

Q71. Find the value of $\sin30° + \cos60°$.
(A) 1/2 (B) 1 (C) 3/2 (D) 0

Q72. If $\tan\theta = 1$, find θ $(0° \leq \theta \leq 90°)$.
(A) 30° (B) 45° (C) 60° (D) 90°

Q73. Find $\sin^2 45° + \cos^2 45°$.
(A) 0 (B) 1/2 (C) 1 (D) 2

Q74. Angle of elevation of a tower's top from a point 30 m away is 30°. Find the height ($\sqrt{3} \approx 1.73$).
(A) 15 m (B) 17.3 m (C) 20 m (D) 25.9 m

Q75. Find the value of $(1 - \cos^2\theta)/\sin^2\theta$.
(A) 0 (B) 1 (C) $\sin\theta$ (D) $\cos\theta$

Elementary Statistics

Q76. Find the mean of 10, 20, 30, 40, 50.
(A) 25 (B) 28 (C) 30 (D) 32

Q77. Find the median of 5, 8, 12, 15, 20, 22.
(A) 12 (B) 13.5 (C) 14 (D) 15

Q78. Find the mode of 2, 3, 3, 4, 5, 3, 6.
(A) 2 (B) 3 (C) 4 (D) 6

Q79. Find the range of 12, 45, 23, 67, 8, 34.
(A) 49 (B) 55 (C) 59 (D) 62

Q80. The average of 5 numbers is 20. Excluding one number, the average becomes 18. Find the excluded number.
(A) 24 (B) 26 (C) 28 (D) 30

Square Root

Q81. Find √625.
(A) 23 (B) 24 (C) 25 (D) 26

Q82. Find the value of √0.0081.
(A) 0.09 (B) 0.9 (C) 0.009 (D) 9

Q83. Find the square root of 1.44.
(A) 1.1 (B) 1.2 (C) 1.3 (D) 1.4

Q84. If √x = 13, find x.
(A) 156 (B) 169 (C) 172 (D) 186

Q85. Find the smallest number to be added to 1780 to make it a perfect square.
(A) 56 (B) 64 (C) 69 (D) 75

Age Calculations

Q86. Father's age is 3 times his son's. After 12 years, father's age will be twice the son's. Find the son's present age.
(A) 10 (B) 12 (C) 14 (D) 16

Q87. Sum of ages of father and son is 60. Six years ago, father's age was 5 times son's age. Find the son's present age.
(A) 12 (B) 14 (C) 16 (D) 18

Q88. A is 4 years older than B. In 6 years, sum of their ages will be 44. Find B's present age.
(A) 12 (B) 14 (C) 16 (D) 18

Q89. Ratio of ages of A and B is 3:4. After 5 years, ratio becomes 4:5. Find A's present age.
(A) 12 (B) 15 (C) 18 (D) 20

Q90. Average age of a family of 5 is 25. The youngest is 5 years old. Find the average age of the family at the youngest member's birth.
(A) 20 (B) 22.5 (C) 25 (D) 27.5

Calendar & Clock

Q91. What was the day of the week on 15th August 1947?
(A) Thursday (B) Friday (C) Saturday (D) Sunday

Q92. If today is Monday, what day will it be after 65 days?
(A) Tuesday (B) Wednesday (C) Thursday (D) Friday

Q93. At what time between 3 and 4 o'clock will the hands of a clock be together?
(A) 3:14(6/11) (B) 3:15 (C) 3:16(4/11) (D) 3:18

Q94. Find the angle between the hour and minute hand at 4:00.
(A) 100° (B) 110° (C) 120° (D) 130°

Q95. How many times do the hands of a clock coincide in 24 hours?
(A) 20 (B) 22 (C) 24 (D) 44

Pipes & Cistern

Q96. Pipe A fills a tank in 6 hours, Pipe B in 8 hours. Together, how long will they take?
(A) 3 hr (B) 3(3/7) hr (C) 4 hr (D) 4½ hr

Q97. A pipe fills a tank in 10 hours; due to a leak it takes 12 hours. In what time can the leak alone empty the full tank?
(A) 50 hr (B) 55 hr (C) 60 hr (D) 65 hr

Q98. Pipes A and B fill a tank in 20 and 30 min. Both open; after 5 min A is closed. Find time for B to fill the rest.
(A) 15 min (B) 17.5 min (C) 20 min (D) 22.5 min

Q99. Two inlets fill a tank in 12 and 15 hours; an outlet empties it in 20 hours. All three opened together — find the time to fill.
(A) 8 hr (B) 9 hr (C) 10 hr (D) 12 hr

Q100. A cistern filled by pipe A in 8 hours takes 2 hours longer due to a leak. Find the time for the leak alone to empty it.
(A) 30 hr (B) 35 hr (C) 40 hr (D) 45 hr

Part C — Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	**B**	2	**C**	3	**B**	4	**C**	5	**C**
6	**B**	7	**B**	8	**B**	9	**B**	10	**C**
11	**A**	12	**B**	13	**B**	14	**B**	15	**C**
16	**A**	17	**D**	18	**A**	19	**B**	20	**C**
21	**B**	22	**A**	23	**C**	24	**B**	25	**B**
26	**A**	27	**C**	28	**B**	29	**B**	30	**B**
31	**B**	32	**C**	33	**A**	34	**B**	35	**C**
36	**C**	37	**B**	38	**C**	39	**B**	40	**B**
41	**B**	42	**B**	43	**B**	44	**C**	45	**B**
46	**C**	47	**B**	48	**B**	49	**B**	50	**B**
51	**B**	52	**C**	53	**B**	54	**B**	55	**B**
56	**C**	57	**C**	58	**C**	59	**C**	60	**B**
61	**B**	62	**B**	63	**A**	64	**C**	65	**B**
66	**C**	67	**B**	68	**C**	69	**B**	70	**B**
71	**B**	72	**B**	73	**C**	74	**B**	75	**B**
76	**C**	77	**B**	78	**B**	79	**C**	80	**C**
81	**C**	82	**A**	83	**B**	84	**B**	85	**C**
86	**B**	87	**B**	88	**B**	89	**B**	90	**C**
91	**B**	92	**B**	93	**C**	94	**C**	95	**B**
96	**B**	97	**C**	98	**B**	99	**C**	100	**C**