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Q1. Find an irrational number between $\frac{1}{7}$ and $\frac{2}{7}$.

Q2. Add $2\sqrt{2}+5\sqrt{3}$ and $\sqrt{2}-3\sqrt{3}$.

Q3. Multiply $6\sqrt{5}$ by $2\sqrt{5}$.

Q4. Divide $8\sqrt{15}$ by $2\sqrt{3}$.

Q5. Write three numbers whose decimal expansions are non-terminating non-recurring.

Q6. Find three different irrational numbers between the rational numbers $\frac{5}{7}$ and $\frac{9}{11}$.

Q7. Simplyfy the folowing expression: $(\sqrt{11}-\sqrt{7})(\sqrt{11}+\sqrt{7})$.

Q8. Classify the following number as rational or irrational:

$$\frac{2\sqrt{7}}{7\sqrt{7}}.$$

Q9. Simplyfy the following expression: $(\sqrt{5}-\sqrt{2})(\sqrt{5}+\sqrt{2})$.

Q10. Rationalise the demoninator of the following:

$$\frac{1}{\sqrt{7}}.$$

Q11. Find five rational numbers between 1 and 2.

Q12. Locate $\sqrt{2}$ on the number line.

Q13. Locate $\sqrt{3}$ on the number line.

Q14. Show that 3.142678 is a rational number. In other words, express 3.142678 in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

Q15. Visualize the representation of $5.3\overline{7}$ on the number line upto 5 decimal places, that is, up to 5.37777.

Q16. Show how $\sqrt{5}$ can be represented on the number line.

Q17. Are the square roots of all positive integers irrational? If not, give an example of the square root of a number that is a rational number.

Q18. Is zero a rational number? Can you write it in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$?

Q19. Rationalise the denominator of $\frac{1}{7+3\sqrt{2}}$.

Q20. Rationalise the denominator of $\frac{5}{\sqrt{3}-\sqrt{5}}$.

Q21. Rationalise the denominator of $\frac{1}{2+\sqrt{3}}$.

Q22. Rationalise the denominator of $\frac{1}{\sqrt{2}}$.

Q23. Check whether $7\sqrt{5}, \frac{7}{\sqrt{5}}, \sqrt{2}+21, \pi-2$ are irrational numbers or not.

Q24. Look at several examples of rational numbers in the form $\frac{p}{q}$ $(q \neq 0)$, where p and q are integers with no common factors other than 1 and having terminating decimal representations (expansions). Can you guess what property q must satisfy?

Q25. Visualise 3.765 on the number line, using successive magnification.

Q26. Recall, π is defined as the ratio of the circumference (say c) of a circle to its diameter (say d). That is, $\pi = \frac{c}{d}$. This seems to contradict the fact that π is irrational. How will you resolve this contradiction?

Q27. Represent $\sqrt{9.3}$ on the number line.

Q28. Simplyfy the folowing expressions: (i) $(5+\sqrt{7})(2+\sqrt{5})$, (ii) $(5+\sqrt{5})(5-\sqrt{5})$.

Q29. Simplyfy:

(i) $2^{\frac{2}{3}} \cdot 2^{\frac{1}{3}}$ (ii) $\left(3^{\frac{1}{5}}\right)^4$.

Q30. Simplyfy the folowing expression: $(\sqrt{3}+\sqrt{7})^2$.

Q31. Write the following in decimal form and say what kind of decimal expansion each has:

(i) $\frac{36}{100}$ (ii) $\frac{1}{11}$

Q32. Write the following in decimal form and say what kind of decimal expansion each has:

(i) $4\frac{1}{8}$ (ii) $\frac{3}{13}$

Q33. Classify the following numbers as rational or irrational:

(i) $\frac{1}{\sqrt{2}}$ (ii) 2π

Q34. Classify the following numbers as rational or irrational:

(i) $2-\sqrt{5}$ (ii) $(3+\sqrt{23})-\sqrt{23}$

Q35. Classify the following numbers as rational or irrational:

(i) 7.478478 ... (ii) 1.101001000100001 ...

Q36. Express the following in the form p/q. where p and q are integers and $q \neq 0$: $0.\overline{001}$.

Q37. Express the following in the form p/q. where p and q are integers and $q \neq 0$: $0.4\overline{7}$.

Q38. Express the following in the form p/q. where p and q are integers and $q \neq 0$: $0.\overline{6}$.

Q39. Write the following in decimal form and say what kind of decimal expansion each has:

(i) $\frac{2}{11}$ (ii) $\frac{329}{400}$

Q40. Simplyfy the following expression: $(\sqrt{5}+\sqrt{2})^2$.

Q41. Rationalise the demoninator of the following:

$$\frac{1}{\sqrt{7}-\sqrt{6}}.$$

Q42. Rationalise the demoninator of the following:

$$\frac{1}{\sqrt{5}+\sqrt{2}}.$$

Q43. Find:

(i) $\frac{11^{\frac{1}{2}}}{11^{\frac{1}{4}}}$ (ii) $7^{\frac{1}{2}} \cdot 8^{\frac{1}{2}}$.

Q44. Rationalise the demoninator of the following:

$$\frac{1}{\sqrt{7}-2}.$$

Q45. Find five rational numbers between $\frac{3}{5}$ and $\frac{4}{5}$.

Q46. Show that $0.2353535... = 0.2\overline{35}$ can be expressed in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

Q47. Find six rational numbers between 3 and 4.

Q48. Show that $1.272727... = 1.\overline{27}$ can be expressed in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

Q49. Find the decimal expansions of $\frac{10}{3}$, $\frac{7}{8}$ and $\frac{1}{7}$.

Q50. Are the following statements true or false? Give reasons for your answers.

(i) Every whole number is a natural number. (ii) Every integer is a rational number.

(iii) Every rational number is an integer.

Q51. State whether the following staments are true or false. Give reasons for your answers.

(i) Every natural number is a whole number. (ii) Every integer is a whole number.

(iii) Every rational number is a whole number.

Q52. Show that $0.3333... = 0.\overline{3}$ can be expressed in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

Q53. Express $0.99999...$ in the form $\frac{p}{q}$. Are you surprised by your answer? With your teacher and classmates discuss why the answer makes sense.

Q54. State whether the following statements are true of false. Justify your answers.

(i) Every irrational number is a real number.

(ii) Every point of the number line is of the form $\sqrt{m}$, where m is a natural number.

(c) Every real number is an irrational number.

Q55. What can the maximum number of digits be in the repeating block of digits in the decimal expansion of $\frac{1}{17}$? Perform the division to check your answer.

Q56. Simplyfy:

(i) $\frac{7^{\frac{1}{5}}}{7^{\frac{1}{3}}}$ (ii) $13^{\frac{1}{5}} \cdot 17^{\frac{1}{5}}$

Q57. Find:

(i) $2^{\frac{2}{3}} \cdot 2^{\frac{1}{5}}$ (ii) $\left(\frac{1}{3^3}\right)^7$.

Q58. Find:

(i) $16^{\frac{3}{4}}$ (ii) $125^{\frac{-1}{3}}$

Q59. Find:

(i) $9^{\frac{3}{2}}$ (ii) $32^{\frac{2}{5}}$.

Q60. Simplyfy each of the following expressions:

(i) $(3+\sqrt{3})(2+\sqrt{2})$ (ii) $(3+\sqrt{3})(3-\sqrt{3})$

Q61. Classify the following numbers as rational or irrational:

(i) $\sqrt{23}$ (ii) $\sqrt{225}$ (iii) 0.3796

Q62. You know that $\frac{1}{7} = 0.\overline{142857}$. Can you predict what the decimal expansions of $\frac{2}{7}, \frac{3}{7}, \frac{4}{7}, \frac{5}{7}, \frac{6}{7}$ are, without actually doing the long division? If so, how?

[Hint: Study the remainders while finding the value of $\frac{1}{7}$ carefully.]

Q63. Visualise $4.\overline{26}$ on the number line, up to 4 decimal places.

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S1. 0.150150015000....

S2. $3\sqrt{2}+2\sqrt{3}$.

S3. 60.

S4. $4\sqrt{5}$.

S5. 0.01001000100001 ..., 0.202002000200002 ..., 0.003000300003 ...

S6. 0.750750075000750000 ..., 0.767076700767000767 ..., 0.808008000800008 ...

S7. 4.

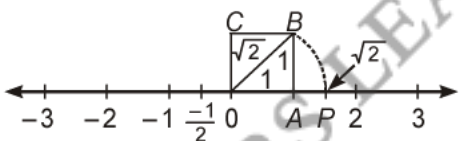
S8. Rational.

S9. 3.

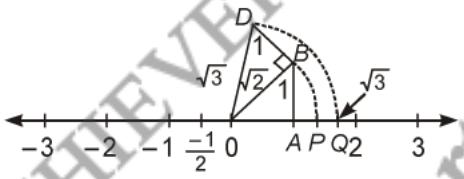
S10. $\frac{\sqrt{7}}{7}$.

S11. $\frac{3}{2}, \frac{5}{4}, \frac{11}{8}, \frac{13}{8}, \frac{7}{4}$.

S12.



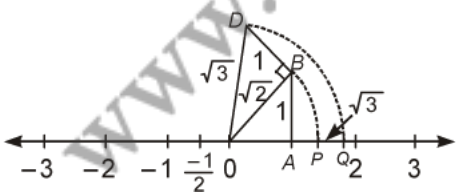
S13.



S14. 3142678/1000000

S15. Visualize yourself.

S16.



S17. No. example, $\sqrt{4}=2$ is a rational number.

S18. Yes. $0=\frac{0}{1}=\frac{0}{2}=\frac{0}{3}$ etc., denominator q can also be taken as negative integer.

S19. $\frac{7-3\sqrt{2}}{31}$.

S20. $\left(\frac{-5}{2}\right)(\sqrt{3}+\sqrt{5})$.

S21. $2-\sqrt{3}$.

S22. $\frac{\sqrt{2}}{2}$.

S23. All these are non-terminating non-recurring decimals.
So, all these are irrational numbers.

S24. The prime factorisation of q has only powers of 2 or powers of 5 or both.

S25. Try yourself.

S26. There is no contradiction. Remember that when you measure a length with a scale or any other device, you only get an approximate rational value. So, you may not realise that either c or d is irrational.

S27. **Represent yourself**

S28. (i) $10+5\sqrt{5}+2\sqrt{7}+\sqrt{35}$ (ii) 20

S29. (i) 2 (ii) $3^{\frac{4}{5}}$

S30. $10+2\sqrt{21}$.

S31. (i) 0.36, terminating. (ii) $0.\overline{09}$. nonterminating repeating.

S32. (i) 4.125, terminating. (ii) $0.\overline{230769}$, mom-terminating repeating.

S33. (i) Irrational (ii) Irrational

S34. (i) Irrational (ii) Rational

S35. (i) rational, and (ii) irrational.

S36. $\frac{1}{999}$.

S37. $\frac{43}{90}$

S38. $\frac{2}{3}$ [Let $x = 0.666\ldots$. So $10x = 6.666\ldots$, or, $10x = 6 + x$ or, $x = \frac{6}{9} = \frac{2}{3}$]

S39. (i) $0.\overline{18}$, non-terminating repeating. (ii) 0.8225, terminating.

S40. $7+2\sqrt{10}$.

S41. $\sqrt{7}+\sqrt{6}$.

S42. $\frac{\sqrt{5}-\sqrt{2}}{3}$.

S43. (i) $11^{\frac{1}{4}}$ (ii) $56^{\frac{1}{2}}$

S44. $\frac{\sqrt{7}+2}{3}$.

S45. $\frac{3}{5}=\frac{30}{50}, \frac{4}{5}=\frac{40}{50}$. Therefore, five rationals are : $\frac{31}{50}, \frac{32}{50}, \frac{33}{50}, \frac{34}{50}, \frac{35}{50}$.

S46. 233/990

S47. There can be infinitely many rationals between numbers 3 and 4, one way is to take them $3=\frac{21}{6+1}, 4=\frac{28}{6+1}$. Then the six numbers are $\frac{22}{7}, \frac{23}{7}, \frac{24}{7}, \frac{25}{7}, \frac{26}{7}, \frac{27}{7}$.

S48. 14/11

S49. (i) 3.333.... (ii) 0.875.... (iii) 0.1428577....

S50. (i) False (ii) True (iii) False

S51. (i) True, since the collection of whole numbers contains all the natural numbers.
(ii) False, for example – 2 is not a whole number.
(iii) False, for example $\frac{1}{2}$ is a rational number but not a whole number.

S52. $x = 1/3$

S53. 1 [Let $x = 0.9999\ldots$. So $10x = 9.999\ldots$, or, $10x = 9 + x$ or, $x = 1$]

S54. (i) True, since collection of real numbers is made up of rational and irrational numbers.
(ii) False, no negative number can be the square root of any natural number.
(iii) False for example 2 is real but not irrational.

S55. $0.\overline{0588235294117647}$.

S56. (i) $7^{\frac{-2}{15}}$ (ii) $221^{\frac{1}{5}}$

S57. (i) $2^{\frac{13}{15}}$ (ii) 3^{-21}.

S58. (i) 8 (ii) $\frac{1}{5}[(125)^{-\frac{1}{3}}=(5^3)^{-\frac{1}{3}}=5^{-1}]$.

S59. (i) 27 (ii) 4.

S60. (i) $6+3\sqrt{2}+2\sqrt{3}+\sqrt{6}$ (ii) 6

S61. (i) irrational; (ii) and (iii) rational.

S62. $\frac{2}{7} = 2 \times \frac{1}{7} = 0.\overline{285714}$, $\frac{3}{7} = 3 \times \frac{1}{7} = 0.\overline{428571}$, $\frac{4}{7} = 4 \times \frac{1}{7} = 0.\overline{571428}$,

$\frac{5}{7} = 5 \times \frac{1}{7} = 0.\overline{714285}$, $\frac{6}{7} = 6 \times \frac{1}{7} = 0.\overline{857142}$.

S63. Try yourself.