Case Study 3:

During a math Olympiad training camp, students are given the task of identifying rational and irrational numbers from a mixed list. They must justify their answers using decimal expansions. One of the problems asks students to determine if numbers like $\sqrt{7}$, $\frac{11}{4}$, and $0.333\ldots$ are rational or irrational. The session focuses on identifying patterns in decimal expansions to classify numbers correctly.

MCQ Questions:

1. Which of the following has a terminating decimal expansion?

   (a) $\frac{1}{6}$

   (b) $\frac{7}{20}$

   (c) $\frac{2}{3}$

   (d) $\frac{5}{9}$

   Answer: (b)
   Solution: Denominator $= 2^2 \times 5$, so decimal terminates.

2. $\sqrt{7}$ is:

   (a) A rational number

   (b) A whole number

   (c) An irrational number

   (d) A natural number

   Answer: (c)
   Solution: $\sqrt{7}$ is not a perfect square and its decimal is non-terminating, non-repeating.

3. $\frac{1}{3}$ in decimal form is:

   (a) 0.3

   (b) 0.33

   (c) $0.333\ldots$

   (d) 0.3333

   Answer: (c)
   Solution: $\frac{1}{3} = 0.333\ldots$, non-terminating, repeating.

4. Identify the rational number from the list below:

   (a) $\sqrt{11}$

   (b) $0.121212\ldots$

(c) π

(d) $\sqrt{2}$

Answer: (b)
Solution: Repeating decimal implies the number is rational.

5. Which number has a non-terminating, non-repeating decimal expansion?

(a) $\frac{2}{9}$

(b) $0.999\ldots$

(c) $\sqrt{13}$

(d) $\frac{1}{5}$

Answer: (c)
Solution: $\sqrt{13}$ is irrational, hence non-terminating, non-repeating.