4.2 Irrational Numbers

Natural Numbers (strictly positive):	$\{1, 2, 3, \ldots\}$
Whole Numbers:	$\{0, 1, 2, 3, \ldots\}$
Integers :	$\{\ldots -3, -2, -1, 0, 1, 2, 3 \ldots\}$
Rational Numbers:	1) Can be written in fraction form $\frac{m}{n}$, $n \neq 0$, where m and n are whole numbers. 2) As radicals, they do have exact roots. ex: $\sqrt{25}$ 3) When converted to decimal form, they either terminate (end) or repeat (pattern). $\frac{4}{6} = 0.\overline{6}$ $\frac{1}{10} = 0.1$
Irrational Numbers :	1) As radicals, they do not have exact roots. 2) When converted to decimal form, they are non-repeating. Therefore, they cannot be written as fractions. $\sqrt{3} = 1.73205\ldots$ $\pi = 3.14159\ldots$

Example 1: Classify the following numbers as rational or irrational

a) $\sqrt{16}$ $\sqrt{16} = 4$ rational

b) $\frac{-3}{5}$ $= -0.6$ rational

c) $\sqrt[3]{32}$ $= 3.1748\ldots$ irrational

d) $0.1818\ldots$ rational (repeating decimal)

e) $\sqrt{\frac{4}{9}}$ $= \frac{2}{3} = 0.\overline{6}$ rational

f) 1.276 rational (terminating decimal)

g) $\sqrt[3]{0.12}$ $= 0.4932\ldots$ irrational

h) $\frac{\pi}{2}$ $= 1.5708\ldots$ irrational

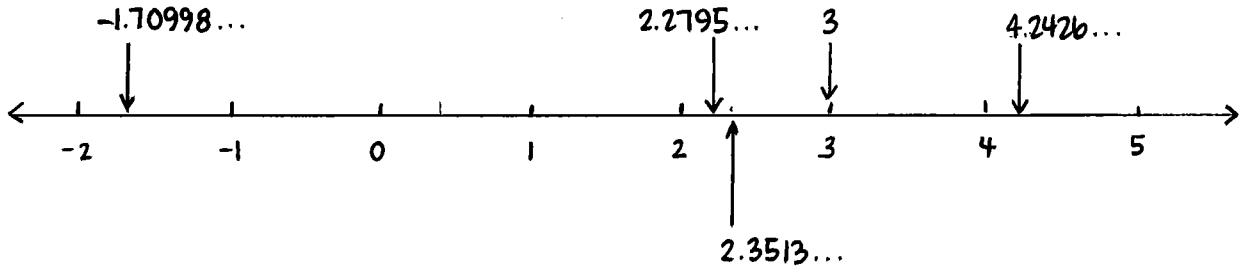
i) $\sqrt{\frac{18}{5}}$ $= 1.8974\ldots$ irrational

j) $-\sqrt{0.25}$ $= -0.5$ rational

★ rewrite all # as decimals.

Example 2: Order the following rational and irrational numbers on a number line.

$\sqrt[3]{13}$ = 2.3513... $\sqrt{18}$ = 4.2426... $\sqrt{9}$ = 3 $\sqrt[4]{27}$ = 2.2795... $\sqrt[3]{-5}$ = −1.70998...



Write the above radicals in order of least to greatest.

$\sqrt[3]{-5}$, $\sqrt[4]{27}$, $\sqrt[3]{13}$, $\sqrt{9}$, $\sqrt{18}$

Example 3: Why are $\sqrt[3]{27}$ and $\sqrt{64}$ rational numbers but $\sqrt[3]{13}$ and $\sqrt{8}$ are irrational numbers?

27 is a perfect cube and $\sqrt[3]{27} = 3$ (3 is an integer)

64 is a perfect square and $\sqrt{64} = 8$ (8 is an integer)

13 is not a perfect cube
$\sqrt[3]{13}$ = 2.3513... , non-terminating, non repeating decimal

8 is not a perfect square
$\sqrt{8}$ = 2.8284... non terminating, non-repeating decimal

Practice: p. 211 #3 – 5, 9a, 10a, 11, 15, 18ab