

# 12. [Exploring Number]

## Skill 12.1 Using 'order of operations' involving a mix of ( ), ×, ÷, + or -

MMMaive 1 1 2 2 3 3 4 4  
MMLime 1 1 2 2 3 3 4 4

- Follow this order of operations:  
Simplify inside the brackets.  
Multiply ( × ) and/or divide ( ÷ ) in order from left to right.  
Add ( + ) and/or subtract ( - ) in order from left to right.

**Q.**  $18 \div (9 - 3) + 2 =$

**A.**  $18 \div (9 - 3) + 2 =$

$= 18 \div 6 + 2$

*simplify the brackets first*

$= 3 + 2$

*division before addition*

$= 5$

**a)**  $6 + 12 \div 4 \times 3 =$

$= 6 + 3 \times 3$

$= 6 + 9$

$=$

**b)**  $6 \times 15 - 8 \times 3 =$

$=$

$=$

$=$

**c)**  $5 + 12 \div 6 \times 3 =$

$=$

$=$

$=$

**d)**  $3 \times (5 - 3) \times 8 =$

$=$

$=$

$=$

**e)**  $(15 + 8) - (7 + 6) =$

$=$

$=$

$=$

**f)**  $120 \div 5 - 6 \times 3 =$

$=$

$=$

$=$

**g)**  $7 \times 8 + 24 \div 2 - 5 \times 6 =$

$=$

$=$

$=$

**h)**  $120 \div (2 + 5 \times 2) - 9 =$

$=$

$=$

$=$

**i)**  $100 - 5 \times (4 + 8) \div 4 - 55 =$

$=$

$=$

$=$

**j)**  $13 + 6 \times 3 - 5 \times (2 + 4) =$

$=$

$=$

$=$

**k)**  $27 - 3 \times (5 + 7) \div 6 + 10 =$

$=$

$=$

$=$

**l)**  $5 + 3 \times 9 - 3 \times (2 + 8) =$

$=$

$=$

$=$

## Skill 12.2 Using 'order of operations' involving powers and ( ), ×, ÷, + or -

MMMaive 1 1 2 2 3 3 4 4  
MMLime 1 1 2 2 3 3 4 4

- Follow this order of operations:  
Simplify inside the brackets.  
Evaluate all powers.  
Multiply ( × ) and/or divide ( ÷ ) in order from left to right.  
Add ( + ) and/or subtract ( - ) in order from left to right.

**Q.**  $(6 + 2 \times 5)^2 =$

**A.**  $(6 + 2 \times 5)^2 =$   
 $= (6 + 10)^2$  *multiply within brackets first*  
 $= 16^2$  *add within the brackets*  
 $= 256$

**a)**  $(3 + 5)^2 =$

$= 8^2$   $=$

**b)**  $(12 - 7)^2 =$

$=$   $=$

**c)**  $(5 + 5 \times 3)^2 =$

$=$   $=$

**d)**  $(2 \times 4 + 6)^2 =$

$=$   $=$

**e)**  $(2 + 8)^2 \div 4 =$

$=$   $=$

**f)**  $(7 + 5)^2 \div 8 =$

$=$   $=$

**g)**  $5 + (12 - 6)^2 =$

$=$   $=$

**h)**  $8 + (13 - 8)^2 =$

$=$   $=$

**i)**  $(4 \times 2 + 2)^2 =$

$=$   $=$

**j)**  $(3 \times 4 + 8)^2 =$

$=$   $=$

**k)**  $(10 - 6)^2 \div (20 - 18) =$

$=$   $=$

**l)**  $(10 - 5)^2 \div (14 - 9) =$

$=$   $=$

### Skill 12.3 Rounding decimal numbers to a given place.

To round terminating decimals to a given place:

- Circle the digit to the right of the requested place.
- If this digit is: 0, 1, 2, 3 or 4 ( $< 5$ ) - **round down** - keep the digit in the requested place the same.  
5, 6, 7, 8 or 9 ( $\geq 5$ ) - **round up** - add 1 to the digit in the requested place.

To round repeating decimals to a given place:

- Write the first 4 digits after the decimal point. (see skill 7.7, page 81)
- Apply the procedure described above for terminating decimals.

**Q.** Round  $0.4\bar{6}$  to the nearest thousandth.

**A.**  $0.4\bar{6} = 0.4666\dots$

6 is repeating indefinitely

0.4666... circle the fourth digit

$\approx 0.467$   $6 \geq 5$  round up by adding 1 to 6

**a)** Round 0.13 to the nearest tenth.

0.13  $3 < 5$  round down by keeping 1

0.1

**b)** Round 7.89 to the nearest tenth.

**c)** Round 12.45 to the nearest tenth.

**d)** Round 31.5841 to the nearest hundredth.

31.5841  $4 < 5$  round down by keeping 8

31.58

**e)** Round 24.793 to the nearest hundredth.

**f)** Round 4.231 to the nearest hundredth.

**g)** Round 3.859 to the nearest tenth.

**h)** Round 50.296 to the nearest hundredth.

**i)** Round  $4.\bar{7}$  to the nearest hundredth.

$4.\bar{7} = 4.777\dots$   $7 \geq 5$  round up by adding 1 to 7

$\approx 4.78$

**j)** Round  $3.\bar{42}$  to the nearest hundredth.

$\approx$

**k)** Round  $0.\bar{6}$  to the nearest hundredth.

$\approx$

**l)** Round  $1.\bar{73}$  to the nearest thousandth.

$\approx$

**m)** Round  $4.2\bar{8}$  to the nearest thousandth.

$\approx$

**n)** Round  $0.1\bar{6}$  to the nearest thousandth.

$\approx$

## Skill 12.4 Writing rational approximations of simple irrational numbers.

MMMaive 1 2 3 3 4 4  
MMLime 1 1 2 2 3 3 4 4

irrational number  $\sqrt{2} \approx 1.41421356$  rational approximation

- Circle the digit to the right of the requested place.
- If this digit is: 0, 1, 2, 3 or 4 ( $< 5$ ) - **round down** - keep the digit in the requested place the same.  
5, 6, 7, 8 or 9 ( $\geq 5$ ) - **round up** - add 1 to the digit in the requested place.

*Hint: To write a decimal number correct to two decimal places is the same thing as rounding off to the nearest hundredth.*

**Q.**  $\cos 45^\circ \approx 0.70711$   
Write the rational approximation of  $\cos 45^\circ$  correct to two decimal places.

**A.**  $0.70\textcircled{7}11$   
circle the third digit

$0.71$   
 $7 \geq 5$   
round up by adding 1 to 0

**a)**  $\sqrt{12} \approx 3.46410162$   
Write the rational approximation of  $\sqrt{12}$  correct to two decimal places.

$3.46\textcircled{4}10162$   
 $4 < 5$   
round down by keeping 6  
 $\approx$

**b)**  $\sqrt{20} \approx 4.47213595$   
Write the rational approximation of  $\sqrt{20}$  correct to two decimal places.

$\dots \approx$

**c)**  $\sqrt{24} \approx 4.89897949$   
Write the rational approximation of  $\sqrt{24}$  correct to two decimal places.

$\dots \approx$

**d)**  $\sqrt{30} \approx 5.47722558$   
Write the rational approximation of  $\sqrt{30}$  correct to two decimal places.

$\dots \approx$

**e)**  $\pi \approx 3.14159265$   
Write the rational approximation of  $\pi$  correct to three decimal places.

$\dots \approx$

**f)**  $\phi \approx 1.61803398$   
Write the rational approximation of  $\phi$  correct to three decimal places.

$\dots \approx$

**g)**  $\sin 15^\circ \approx 0.25882$   
Write the rational approximation of  $\sin 15^\circ$  correct to three decimal places.

$\dots \approx$

**h)**  $\tan 60^\circ \approx 1.73205$   
Write the rational approximation of  $\tan 60^\circ$  correct to three decimal places.

$\dots \approx$

**i)**  $e \approx 2.71828182$  (Euler's number)  
Write the rational approximation of  $e$  correct to two decimal places.

$\dots \approx$

**j)**  $\sqrt{10} \approx 3.16227766$   
Write the rational approximation of  $\sqrt{10}$  correct to three decimal places.

$\dots \approx$

## Skill 12.5 Writing very large and very small numbers in scientific notation.

MMMaue 11 2 3 4 4  
MMLime 11 2 3 4 4

<b>243,000</b> <b>Standard Form</b> Very large	$=$	$2.43 \times 10^5$ <b>Scientific Notation</b> Product of: Number $\geq 1$ and $< 10$ Power of 10 with positive exponent	<b>0.000802</b> <b>Standard Form</b> Very small	$=$	$8.02 \times 10^{-4}$ <b>Scientific Notation</b> Product of: Number $\geq 1$ and $< 10$ Power of 10 with negative exponent
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To find the number greater than or equal to 1 and less than 10:

- Move the decimal point after the first non-zero digit and count the places moved.
- Write this number ignoring the zeros at either end.

To find the power of 10:

- Write base 10 with an exponent equal to the number of places moved.
- Check the sign of the exponent: Decimal point moves left  $\Rightarrow$  positive exponent.  
 Decimal point moves right  $\Rightarrow$  negative exponent.

**Q.** Write 384,000,000 meters, the distance from earth to moon, in scientific notation.

**A.**  $384,000,000$  (8 places)  
 $= 3.84 \times 100,000,000$  (8 zeros)  
 $= 3.84 \times 10^8$  (exponent = +8 because of the 8 places and large original number ( $> 3.84$ ))

**a)** 73,000 written in scientific notation is:  
 A)  $7.3 \times 10^{-4}$  B)  $0.73 \times 10^5$  C)  $7.3 \times 10^4$

$73,000$  (4 places)  
 (4 zeros) exponent = +4  
 $= 7.3 \times 10,000 = 7.3 \times 10^4 = \boxed{C}$

**b)** 5,010,000 written in scientific notation is:  
 A)  $5.01 \times 10^6$  B)  $5.1 \times 10^5$  C)  $5.01 \times 10^5$

$5,010,000$   
 $=$   $\boxed{\phantom{000000}}$

**c)** Some people have as many as 150,000 hair follicles on their head. Write this in scientific notation.

$= \boxed{\phantom{000000}}$

**d)** By 2010 the world's population is estimated to reach 6.84 billion people. Write this in scientific notation.

$= \boxed{\phantom{000000}}$

**e)** 0.00304 written in scientific notation is:  
 A)  $3.4 \times 10^{-4}$  B)  $3.04 \times 10^{-3}$  C)  $3.04 \times 10^{-4}$

$0.00304$  (3 places)  
 (3 zeros) exponent = -3  
 $= 3.04 \times 1000 = 3.04 \times 10^3 = \boxed{\phantom{000000}}$

**f)** 0.000051 written in scientific notation is:  
 A)  $5.1 \times 10^{-5}$  B)  $5.1 \times 10^5$  C)  $5.1 \times 10^{-4}$

$=$   $\boxed{\phantom{000000}}$

**g)** Write 0.00000024 m, the diameter of a human hair strand, in scientific notation.

$= \boxed{\phantom{000000}}$

**h)** In diamonds, the distance between two carbon atoms is 0.000000142 m. Write this in scientific notation.

$= \boxed{\phantom{000000}}$

**Skill 12.6** Expressing numbers in standard form.

$2.43 \times 10^5$ <b>Scientific Notation</b> Product of: Number $\geq 1$ and $< 10$ Power of 10 with positive exponent	=	$243,000$ <b>Standard Form</b> Very large
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$8.02 \times 10^{-4}$ <b>Scientific Notation</b> Product of: Number $\geq 1$ and $< 10$ Power of 10 with negative exponent	=	$0.000802$ <b>Standard Form</b> Very small
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If the power of 10 is **positive**:

- Move the decimal point to the right as many places as the power of 10.
- Add zeros as place holders if necessary.  
Example:  $3.1 = 3.1000$   
Hint: By convention  $37 = 37. = 37.0$

If the power of 10 is **negative**:

- Move the decimal point to the left as many places as the power of 10.
- Add zeros as place holders if necessary.  
Example:  $4.5 = 00004.5$
- If the result is less than 1, write a zero in the units place.  
Hint: By convention  $0.37$  not  $.37$

**Q.** Write  $3.5 \times 10^{-4}$  m, the diameter of optical fiber, in standard form.

**A.**  $3.5 \times 10^{-4}$  exponent = -4  
 $= 00003.5 \times 10^{-4}$  move decimal point 4 places left  
add zeros as place holders  
 $= 0.00035$

**a)**  $6.2 \times 10^5$  is the scientific notation for:

- A) 6200 B) 620,000 C) 6.20000

$6.2 \times 10^5 =$  exponent = +5

$= 620,000.00$  5 places right B

**b)**  $4.12 \times 10^6$  is the scientific notation for:

- A) 4,120,000 B) 412,000 C) 4.120000

$=$

**c)** Earth's atmosphere extends upward for  $9.65 \times 10^5$  m. Write this in standard form.

**d)** Write  $1.3 \times 10^9$ , China's population in 2006, in standard form.

**e)** The size of a red blood cell,  $8.0 \times 10^{-3}$  mm, is scientific notation for:

- A) 0.0008 B) 8000 C) 0.008

$=$

**f)** The size of a virus,  $2.5 \times 10^{-5}$  mm, is scientific notation for:

- A) 0.00025 B) 0.000025 C) 250,000

$=$

**g)** Write  $2.5 \times 10^{-11}$  m, the radius of a hydrogen atom, in standard form.

**h)** Write  $5 \times 10^{-7}$  m, the size of a speck of dust, in standard form.

## Skill 12.7 Using 'order of operations' involving negative integers.

MMMaive 11 2 2 3 3 4 4  
MMLime 11 2 2 3 3 4 4

- Follow this order of operations:  
Simplify inside the brackets.  
Multiply ( $\times$ ) and/or divide ( $\div$ ) in order from left to right.  
Add ( $+$ ) and/or subtract ( $-$ ) in order from left to right.

**Q.**  $-9 \div 3 - 5 \times (-10) =$

**A.**  $-9 \div 3 - 5 \times (-10) =$

$= -3 - (-50)$

divide and multiply first

$= -3 + 50$

$= 47$

subtract, use "+"

**a)**  $(12 - 2) \div (9 - 11) =$

$= 10 \div (-2)$

$=$

**b)**  $-56 \div 8 - 4 \times 7 =$

$=$

$=$

**c)**  $-12 \div 4 + (-3) \times 4 =$

$=$

$=$

**d)**  $(-15 + 11) \times (9 - 14) =$

$=$

$=$

**e)**  $-8 \times 6 - 42 \div 7 =$

$=$

$=$

**f)**  $(9 - 17) \div (-6 + 8) =$

$=$

$=$

**g)**  $(13 + 11) \times (7 - 10) =$

$=$

$=$

**h)**  $-3 \times 7 - 12 \div 6 =$

$=$

$=$

**i)**  $15 - 8 \times (10 - 5) \div 4 - 12 =$

$=$

$=$

**j)**  $-7 + 12 \div (4 + 8) \times 6 + 10 =$

$=$

$=$

**k)**  $-4 + 2 \times (8 - 12) \div 4 - 12 =$

$=$

$=$

**l)**  $1 - 16 \div (3 + 5) \times 3 - 15 =$

$=$

$=$

**m)**  $-10 \times (14 - 7) =$

$=$

$=$

**n)**  $-28 \div (-1 - 6) + 17 =$

$=$

$=$

**o)**  $-9 - 4 \times (13 - 2) =$

$=$

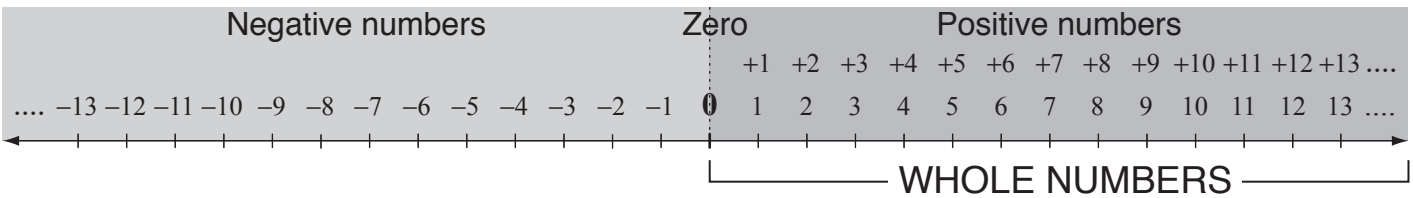
$=$

**p)**  $-9 - 2 \times (19 - 3) =$

$=$

$=$

## INTEGERS



- Decide if a number is a whole number or an integer, based on their definition and hints below.  
(see Glossary)

**Hints:** Negative numbers, fractions, terminating decimals, repeating decimals and infinite non-repeating decimals are not whole numbers.

Any fraction whose numerator is divisible by the denominator is a whole number:  $\frac{12}{4} = 3$

Any decimal with only zeros after the decimal point is a whole number:  $8.00 = 8$

Fractions, terminating decimals, repeating decimals and infinite non-repeating decimals are not integers.

Any fraction whose numerator is divisible by the denominator is an integer:  $-\frac{5}{1} = -5$ ,  $\frac{12}{4} = 3$

Any decimal with only zeros after the decimal point is an integer:  $8.00 = 8$

Any square root of a perfect square is an integer:  $\sqrt{16} = 4$

- Q.** Choose the whole numbers from this list:

$$-7, \frac{8}{2}, -\frac{1}{3}, 0, -3.6, 50$$

- A.**  $-7$  is negative, so not a whole number

$$\frac{8}{2} = 8 \div 2 = 4 \text{ is a whole number}$$

$-\frac{1}{3}$  is a fraction, so not a whole number

$-3.6$  is a decimal, so not a whole number

So  $\frac{8}{2}$ ,  $0$ ,  $50$  are whole numbers.

- a)** Choose the whole numbers from this list:

$$7.43, \textcircled{89}, -5, 3\frac{1}{5}, \textcircled{14}, 0.6$$

- b)** Choose the whole numbers from this list:

$$567, 0.73, -4, \frac{3}{10}, 12, 0$$

- c)** Choose the whole numbers from this list:

$$1.4142, 18, -5.\bar{9}, \frac{4}{11}, -5, 143$$

- d)** Choose the whole numbers from this list:

$$-25, 0.6666\dots, 34, \frac{5}{7}, -1, 8.93567$$

- e)** Choose the integers from this list:

$$-3.5, 11, 2.\bar{14}, -1, 3\frac{2}{7}, 2$$

- f)** Choose the integers from this list:

$$3.14, \frac{16}{4}, -3, -0.\bar{72}, \sqrt{25}$$

- g)** Choose the integers from this list:

$$-75, 2.23607, -\frac{8}{2}, \sqrt{90}, 10.00$$

- h)** Choose the integers from this list:

$$-\sqrt{4}, \frac{\pi}{4}, 0.5252, 18, 0$$

## Skill 12.9 Recognizing rational numbers.

A number is **rational** if:

- It can be written as a fraction (ratio) of two integers.

*Hint: All integers are rational numbers:  $-2, 700, \sqrt{16}, \frac{5}{1}, \frac{25}{5}$*

*All terminating decimals are rational numbers:  $2.16, -5.753469$*

*All repeating decimals are rational numbers:  $0.57575757\dots = 0.\overline{57}$*

**Q.** Which numbers are rational?

- A)  $-\sqrt{\frac{3}{5}}$   
 B)  $0.999\dots$   
 C)  $0.12357102\dots$   
 D)  $\frac{11}{2}$

**A.**  $-\sqrt{\frac{3}{5}}$  is not rational, because  $\frac{3}{5}$  is not a perfect square.

$0.999\dots$  is rational, because it is a repeating decimal.

$0.12357102\dots$  is not rational, because it has infinite non-repeating digits after the decimal point.

$\frac{11}{2}$  is rational, because it is a fraction.

So **B and D** are rational.

**a)** Choose the rational numbers from this list:

$1.41421356\dots, \sqrt{\frac{1}{4}}, -\frac{1}{3}, 2.18, \frac{\pi}{6}$

**b)** Choose the rational numbers from this list:

$-5.\overline{2}, \frac{3\pi}{2}, \sqrt{10}, 3.14, \frac{659}{3867}$

**c)** Which numbers are rational?

- A)  $\sqrt{\frac{4}{9}}$                       B)  $-\frac{\pi}{4}$   
 C)  $3.14159265\dots$         D)  $1.75$

**A and D**

**d)** Which numbers are **not** rational?

- A)  $3.4\overline{8}$                       B)  $1.61803399\dots$   
 C)  $\frac{\pi}{2}$                               D)  $\sqrt{16}$

**e)** Which numbers are rational?

- A)  $\frac{21}{55}$                               B)  $0.00007$   
 C)  $6.9205729744\dots$         D)  $-\sqrt{6}$

**f)** Which numbers are rational?

- A)  $\sqrt{10}$                               B)  $77.\overline{7}$   
 C)  $-\frac{11}{2}$                               D)  $\sqrt{\frac{3}{7}}$

**g)** Which numbers are rational?

- A)  $\sqrt{8}$                               B)  $6.5\overline{9}$   
 C)  $-4.131133111333\dots$         D)  $3.161616\dots$

**h)** Which numbers are **not** rational?

- A)  $-0.315315315\dots$         B)  $\sqrt{3}$   
 C)  $2.135791113\dots$         D)  $\frac{11}{49}$

## Skill 12.10 Recognizing irrational numbers.

MMMaube 11 22 33 44  
MMLime 11 22 33 44

A number is **irrational** (not rational) if:

- It can be written as a decimal, but not as a fraction.
- It has infinite non-repeating digits after the decimal point: 2.52849302953...

*Hint: Square roots of prime numbers or rational numbers that are not perfect squares are irrational numbers:  $\sqrt{5}$ ,  $\sqrt{18}$*

*Special numbers, such as  $\pi$ ,  $e$ ,  $\phi$  are irrational.*

*Some values of trigonometric and logarithmic functions are irrational.*

**Q.** Which is an irrational number?

- A)  $\sqrt{900}$       B)  $\frac{1}{20}$   
C)  $-\sqrt{38}$       D)  $-5.75$

**A.**  $\sqrt{900}$  is rational, because it equals 30.

$\frac{1}{20}$  is rational, because it is a fraction.

$\sqrt{38}$  is irrational, because it is a square root of a rational number that is not a perfect square.

5.75 is rational, because it is a decimal.

So **C** is an irrational number.

**a)** Which is an irrational number?

- A)  $\phi$       B) 120  
C)  $\sqrt{25}$       D)  $-0.1675$

**A**

**b)** Which is an irrational number?

- A) 0      B)  $-5.636363\dots$   
C)  $\frac{3}{17}$       D)  $\frac{1}{\sqrt{2}}$

**c)** Which is an irrational number?

- A) 3      B)  $-2.5$   
C)  $\sqrt{2}$       D)  $-\sqrt{4}$

**d)** Which is an irrational number?

- A)  $2.\bar{6}$       B) 6.15  
C)  $\sqrt{7}$       D)  $5\frac{3}{10}$

**e)** Which is an irrational number?

- A)  $\frac{659}{3867}$       B) 2.7182813...  
C)  $-9.\bar{42}$       D)  $\sqrt{\frac{9}{4}}$

**f)** Which is an irrational number?

- A) 3.15315315...      B) 5001  
C)  $\frac{3}{10}$       D)  $\sqrt{18}$

**g)** Choose the irrational numbers from this list:

$\sqrt{15}$ ,  $-\frac{2}{3}$ ,  $-6$ ,  $0.13133133313\dots$ ,  $\sqrt{5}$

**h)** Choose the irrational numbers from this list:

$-\frac{3}{14}$ ,  $\sqrt{\frac{3}{5}}$ ,  $\pi$ ,  $\frac{53}{83}$ ,  $0.12357102\dots$

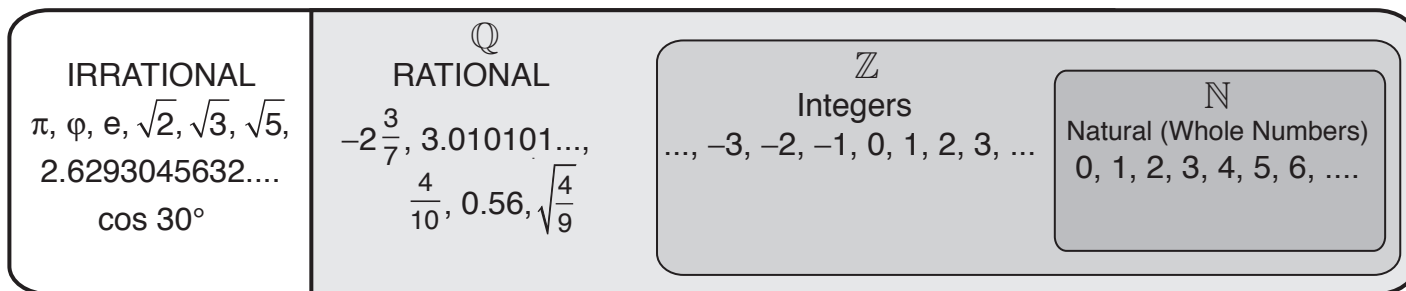
**i)** Choose the irrational numbers from this list:

$\sqrt{30}$ ,  $0.\bar{67}$ ,  $6.921921921\dots$ ,  $-\sqrt{3}$ ,  $\frac{\pi}{2}$

**j)** Choose the irrational numbers from this list:

$1\frac{1}{17}$ ,  $-45$ ,  $3.14159\dots$ ,  $\sqrt{\frac{6}{7}}$ ,  $\phi$

$\mathbb{R}$  REAL NUMBERS



**Hint:** Rational numbers include integers, terminating decimals and repeating decimals.  
Irrational numbers include infinite non-repeating decimals.

$\mathbb{N} \subset \mathbb{Z} \subset \mathbb{Q} \subset \mathbb{R}$   
Irrational numbers  $\subset \mathbb{R}$

- Q.** Which classes of numbers describe  $-\sqrt{81}$ ?      **A.**  $-\sqrt{81} = -9$
- |                            |             |   |
|----------------------------|-------------|---|
| A) integer and irrational  | integer     | ✓ |
| B) rational and real       | rational    | ✓ |
| C) irrational and rational | real number | ✓ |
| D) real and natural        | natural     | ✗ |
|                            | irrational  | ✗ |

So **B** is the correct description.

**a)** Use true and false to complete this table:

	integer	rational	irrational	real
4.327	false	true	false	true

**b)** Use true and false to complete this table:

	integer	rational	irrational	real
-500				

**c)** Use true and false to complete this table:

	integer	rational	irrational	real
$\pi$				

**d)** Use true and false to complete this table:

	integer	rational	irrational	real
$\frac{3}{14}$				

**e)** Which classes of numbers describe 0.65291...?

- A) integer and rational
- B) rational and real
- C) integer and irrational
- D) irrational and real

**f)** Which classes of numbers describe  $-\sqrt{49}$ ?

- A) integer and rational
- B) irrational and real
- C) integer and irrational
- D) rational and irrational

**g)** Which classes of numbers describe  $0.\bar{1}5384\bar{6}$ ?

- A) integer and irrational
- B) irrational and real
- C) integer and rational
- D) rational and real

**h)** Which classes of numbers describe  $\frac{257}{43}$ ?

- A) integer and rational
- B) irrational and real
- C) rational and real
- D) rational and irrational

## Skill 12.12 Comparing and ordering real numbers.

MMMaive 11 22 33 44  
MMLime 11 22 33 44

- Simplify the radical to the simplest form.

To estimate the value of a radical:

EITHER

- Find the perfect squares greater than ( $>$ ) and less than ( $<$ ) the number inside the square root.

OR

- Find the rational approximation of the radical from a table of values. (see Math Facts, page 453)
- Express the real numbers as decimals. (see skill 7.6, page 80)
- Order the decimal numbers. (see skill 7.1, page 75)

**Q.** Place in descending order:

$$\sqrt{7}, \frac{7}{3}, 2.3, \frac{10}{4}, 2.41$$

**A.**  $\sqrt{7} = 2.6457\dots$

$$\frac{7}{3} = 2.3333\dots$$

$$\frac{10}{4} = 2.5$$

Descending means from the largest to smallest: 2.6457, 2.5, 2.41, 2.3333, 2.3

The order is:  $\sqrt{7}, \frac{10}{4}, 2.41, \frac{7}{3}, 2.3$

**a)** Which number is greater:

$\pi$  or 3.1?  $\pi \approx 3.14159$

**b)** Which number is greater:

$\pi$  or  $\sqrt{10}$ ?

**c)** Which number is smaller:

$\sqrt{20}$  or 5?  $\sqrt{20} = 2\sqrt{5} \approx 4.4721$

**d)** Which number is smaller:

$\sqrt{6}$  or 2?

**e)** Which number is smaller:

5 or  $\sqrt{32}$ ?

**f)** Which number is greater:

$\sqrt{50}$  or 7?

**g)** Place in ascending order:

$$\sqrt{6}, \frac{3}{2}, 2.6, 2\bar{4}$$

**h)** Place in descending order:

$$\sqrt{5}, \frac{5}{2}, 1.2, \sqrt{2}, 1.5$$

**i)** Place in descending order:

$$\frac{8}{3}, \sqrt{4}, \sqrt{8}, 2.6, 2.75$$

**j)** Place in ascending order:

$$3.2, \sqrt{9}, \pi, \frac{9}{4}, \sqrt{7}$$