Things you should already know **SOLUTIONS**

Every problem contains a link to the page containing its solution. Some items may have further explanation which you will find by clicking on the button next to it.

Evaluate these and place the letter corresponding to each on the number line below. Place a dot on the number line and the letter above it!

A. $-\sqrt{2}$

B. -2^4

C. 5^0

D. $\pi - 1$

E. $-.3$

F. $.\overline{3}$

G. $\sqrt{3-7}$

H. $|3-5|$

I. $\frac{|x|}{x}$, if $x > 0$

J. $\frac{|x|}{x}$, if $x < 0$

K. additive identity element

L. additive inverse of $\frac{3}{4}$

M. multiplicative identity element

N. multiplicative inverse of $-\frac{3}{4}$

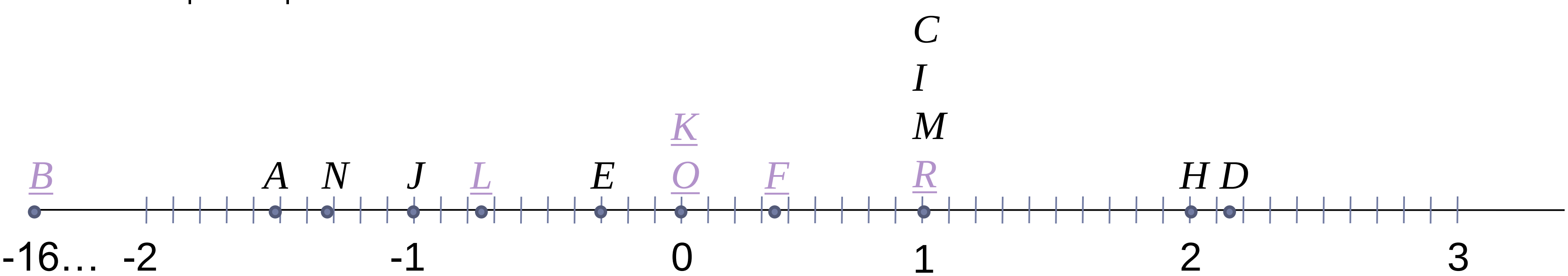
O. $\frac{0}{4}$

P. $\frac{4}{0}$

Q. $\frac{0}{0}$

R. $.\overline{9}$

What happened to P and Q?



NEXT

For the points A-O in the previous problem decide to which of these sets they belong:

- Set of real numbers, $\mathbb{R}$:
  - Real numbers consist of rational and irrational numbers.
  - A, B, C, D, E, F, H, I, J, K, L, M, N, O, R
- Set of rational numbers, $\mathbb{Q}$:
  - Rational numbers are those that can be written as a fraction whose numerator and denominator are integers (denominator can not be 0) .
  - B, C, E, F, H, I, J, K, L, M, N, O, R
- Set of irrational numbers, $\mathbb{I}$:
  - Irrational numbers are those which are not rational.
  - A, D
- Set of integers, $\mathbb{Z}$:
  - {…., -2, -1, 0, 1, 2, ….}
  - B, C, H, I, J, K, M, O
- Set of natural numbers, $\mathbb{N}$:
  - {1, 2, 3, 4, ….}
  - C, I, M, R

NEXT?

List all integers in each of the given intervals

$(-2,4]: -1,0,1,2,3,4$

$($ indicates that the number next to it is not included,

$[$ indicates that the number next to it is included into the interval

$[2,5] = 2,3,4,5$

$(1,\infty): 2,3,4,5,6,7,\ldots$

$(-\infty,1]: \ldots,-4,-3,-2,-1,0,1$

$(3,4): \textit{none}$

NEXT?

Write an example of each of the terms below using $5x^3 - 2x + 4 = 0$

- Equation $5x^3 - 2x + 4 = 0$
- Expression $5x^3 - 2x + 4$
- Term:
  - There are several: $-2x, 5x^3, 4$
- Factor
  - 5 is a factor in $5x^3$ as is x^3; 2 is a factor in $2x$, as is x
- Constant
  - 4, 0
- Coefficient
  - 5 is a coefficient of x^3, -2 is coefficient of x
- Exponent
  - 3 is the exponent of x^3, 1 is exponent of x

NEXT?

Order of operations

$$3\cdot 2-6\div 4+3=6-\frac{6}{4}+3=9-\frac{3}{2}=\frac{15}{2}$$

$$4+3\cdot 2^3\div 4-2=4+\frac{3\cdot 2^3}{4}-2=4+6-2=8$$

$$2x^3-\frac{x}{y}\cdot z+y \qquad \text{if } x=-2, y=3, z=-6:$$

$$2x^3-\frac{x}{y}\cdot z+y=2(-2)^3-\frac{-2}{3}\cdot(-6)+3=$$

$$=2\cdot(-8)+\frac{2\cdot(-6)}{3}+3=-16-4+3=-17$$

NEXT?

Evaluate the following exponents

$$2^3 = 2 \cdot 2 \cdot 2 = 4 \cdot 2 = 8$$

$$-2^3 = -(2 \cdot 2 \cdot 2) = -(4 \cdot 2) = -8$$

$$(-2)^3 = (-2) \cdot (-2) \cdot (-2) = 4 \cdot (-2) = -8$$

$$2^4 = 2 \cdot 2 \cdot 2 \cdot 2 = 4 \cdot 2 \cdot 2 = 8 \cdot 2 = 16$$

$$-2^4 = -(2 \cdot 2 \cdot 2 \cdot 2) = -16$$

$$(-2)^4 = (-2) \cdot (-2) \cdot (-2) \cdot (-2) = 4 \cdot (-2) \cdot (-2) = -8 \cdot (-2) = 16$$

BACK TO PROBLEM 1

NEXT?

Evaluate the following powers – it will be to your advantage to be able to quickly recall and recognize these powers

2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7	2^8	2^9	2^{10}
1	2	4	8	16	32	64	128	256	512	1024
3^0	3^1	3^2	3^3	3^4	3^5					
1	3	9	27	81	243	729				
4^0	4^1	4^2	4^3	4^4						
1	4	16	64	256						
5^0	5^1	5^2	5^3	5^4						
1	5	25	125	625						

NEXT?

Evaluate roots:

$$\sqrt{64} = 8$$

$$\sqrt[3]{64} = 4$$

$$\sqrt[6]{64} = 2$$

$$\sqrt{-64} = 8i$$

$$\sqrt[3]{-64} = -4$$

$$\sqrt[6]{-64} = 2i$$

NEXT?

More exponents

$$64^{2/3} = \sqrt[3]{64^2} = \sqrt[3]{(4^3)^2} = \sqrt[3]{(4^2)^3} = 4^2 = 16$$

$$64^{3/2} = \sqrt{64^3} = \sqrt{(8^2)^3} = \sqrt{(8^3)^2} = 8^3 = 512$$

$$64^{-2/3} = \frac{1}{64^{2/3}} = \frac{1}{16}$$

$$64^{-3/2} = \frac{1}{64^{3/2}} = \frac{1}{512}$$

$$-64^{3/2} = -512$$

$$(-64)^{2/3} = 16$$

NEXT?

Rationalize the following expressions

$$\frac{5}{\sqrt{10}} = \frac{5}{\sqrt{10}} \cdot \frac{\sqrt{10}}{\sqrt{10}} = \frac{5\sqrt{10}}{10} = \frac{\sqrt{10}}{2}$$

$$\frac{3}{\sqrt{5}-2} = \frac{3}{\sqrt{5}-2} \cdot \frac{\sqrt{5}+2}{\sqrt{5}+2} = \frac{3\cdot(\sqrt{5}+2)}{(\sqrt{5}-2)\cdot(\sqrt{5}+2)} = \frac{3\sqrt{5}+6}{5-4} = 3\sqrt{5}+6$$

$$\frac{\sqrt{2x^3}}{\sqrt{8x^6}} = \frac{\sqrt{2x^3}}{\sqrt{2\cdot 4x^3 \cdot x^3}} = \frac{\sqrt{2x^3}}{2\sqrt{2x^3}\sqrt{x^3}} = \frac{1}{2\sqrt{x^3}} \cdot \frac{\sqrt{x^3}}{\sqrt{x^3}} = \frac{\sqrt{x^3}}{2x^3}$$

Rewrite the expressions so that they contain only positive rational exponents

$$\frac{5^{-1/2}\cdot 5x^{5/2}}{(5x)^{3/2}}=\frac{5^{-\frac{1}{2}+1}x^{\frac{5}{2}}}{5^{\frac{3}{2}}x^{\frac{3}{2}}}=\frac{5^{\frac{1}{2}}x^{\frac{5}{2}}}{5^{\frac{3}{2}}x^{\frac{3}{2}}}=\frac{x^{\frac{5}{2}-\frac{3}{2}}}{5^{\frac{3}{2}-\frac{1}{2}}}=\frac{x^{\frac{2}{2}}}{5^{\frac{2}{2}}}=\frac{x}{5}$$

$$\sqrt[3]{\sqrt{8x^3y^6}}=\sqrt{\sqrt[3]{8x^3y^6}}=\sqrt{\sqrt[3]{(2xy^2)^3}}=\sqrt{2xy^2}=(2xy^2)^{\frac{1}{2}}=2^{\frac{1}{2}}x^{\frac{1}{2}}y$$

$$\frac{32\cdot 8\cdot 2^4}{64\cdot 16\cdot 2^{-3}}=2^n \qquad \text{then} \qquad n=?$$

$$\frac{32\cdot 8\cdot 2^4}{64\cdot 16\cdot 2^{-3}}=\frac{1\cdot 1\cdot 2^4}{2\cdot 2\cdot 2^{-3}}=\frac{2^4}{2^{2-3}}=\frac{2^4}{2^{-1}}=2^{4-(-1)}=2^5\Rightarrow n=5.$$

YOU ARE DONE

$.\overline{3}$ and $.\overline{9}$

$$.\overline{3} = m \quad / \cdot 10$$

• We call $.\overline{3}$ m, and we multiply the whole equation by 10.

$$3.\overline{3} = 10m$$

$$3 + .\overline{3} = 10m$$

• Since $.\overline{3}$ is m we can write m instead of it

$$3 + m = 10m \quad / - m$$

• We subtract m from both sides

$$3 = 9m \quad / \div 9$$

•We divide both sides by 9

$$\frac{3}{9} = m$$

$$\frac{1}{3} = m$$

•Similar process is repeated to show that

$$.\overline{9} = 1$$

BACK

Additive identity and inverses

- *Additive identity* is 0. It has the property that for any number *a* we have:

  - $a+0 = 0+a = a$

- *Additive inverse* of any real number *a* is a real number *b* such that
  - $a+b=b+a=0$
  - We call *b the opposite of a,* and denote it by $-a$.

Multiplicative identity and inverses

- *Multiplicative identity* is 1. It has the property that for any number *a* we have:
  - $a*1 = 1*a = a$
- *Multiplicative inverse* of any real number *a* is a real number *b* such that
  - $a*b=b*a=1$
  - We call *b the reciprocal of a.*

BACK

Division of and by 0

- What is important to remember here is that

$$\frac{a}{b} = c \quad \text{means} \quad a = c \cdot b$$

- The answer to the question "what is *a* divided by *b* equal to?" is "the number which multiplied by *b* gives *a*"

  - $\frac{0}{4} = c \Leftrightarrow 4 \cdot c = 0$ the only *c* that will work is 0, so $\frac{0}{4} = 0$
  - $\frac{4}{0} = c \Leftrightarrow 0 \cdot c = 4$ there is no *c* that would make this equation true , so this quotient is undefined
  - $\frac{0}{0} = c \Leftrightarrow c \cdot 0 = 0$ any number can be substituted for c, and the equation will be true. We say that this quotient is indeterminate.

BACK

The End

- To be successful in this course these are the concepts you should be very comfortable with

- If you think you need a refresher on some of these concepts, please visit our online

Math1010