1. my info

2. syllabus

3. first things
   - Q1 due 19th
     - Hw 1 ≥ 90 pre-req
   - Course entry quiz
     - do best, no help w/
   - Test 1 · 1/27
     - In TC
     - modules 1-2

4. Content — Aside, high level, Kinda ignore

Group axioms

Notation: s.t. = such that
$\forall$ — for all
$\exists$ — there exists
$\in$ — in

Let $(G, +)$ be a group then

1. $\forall a, b \in G$, $a + b \in G$

2. $(a+b)+c = a+(b+c)$ — associativity

3. $\exists$ elt 0 s.t. $\forall a \in G$, $a + 0 = 0 + a = a$

4. $\forall a \in G$, $\exists -a \in G$ s.t. $a + -a = 0$

↘ Think rubixks cube actions or integers

Ring axioms

A Ring R is a group with a
multiplication $(\cdot)$ s.t.

1. $\forall r \in R, \ r \cdot 0 = 0 \cdot r = 0$

2. $\exists$ elt 1 s.t. $\forall r \in R, \ 1 \cdot r = r = r \cdot 1$

3. $\forall a, b, c \in R, \ (a+b) \cdot c = a \cdot c + b \cdot c$ — distributive property

4. multiplication is associative

Integral domain

— integers $\mathbb{Z}$
real polys $\mathbb{R}[x]$

A ring R is an integral domain if

1. $\forall a, b \in R \quad a \cdot b = b \cdot a$ — commutivity

2. if $a \cdot b = a \cdot c$ and $a \neq 0$, then
$$b = c$$

equivalently, if $a \cdot b = 0$ then $a = 0$ or $b = 0$

Field An Integral domain F is

a field if

1. $\forall f \neq 0 \in F, \ \exists f^{-1}$ s.t. $f f^{-1} = 1$.

— multiplicative inverse.

Example fields: - Reals $\mathbb{R}$
- rationals $\mathbb{Q}$
- $\mathbb{R}(X)$ — things of form $\dfrac{x^2+3x}{4x^5-7}$

Even more aside
Toward def of an Algebra

Ring map $f: R \to S$ is a ring map (ring homomorphism) if

1. $\forall a,b \in R,$ $f(ab) = f(a)f(b)$
   $f(a+b) = f(a)+f(b)$
   $f(1) = 1$

Algebra — not really thought about much

A ring A equiped with a ring map
$f: R \to A$ is an R-algebra.

Back to intro

Order of operations

high Parenthes/ grouping symbols

Exponents / logs

Multiplication

Division

Addition

low Subtraction

USA, other notations exist

ex Reverse
Polish
notation
(RPN)

$5\ 3\ +\ 7\ \div$ in RPN

is $\dfrac{5+3}{7}$ in ours.

Fractions

From an integral domain

D, we may form a field by

for $a \in D$, $b \neq 0 \in D$ forming fractions

$\frac{a}{b}$, where $\frac{a}{b} \sim \frac{c}{d}$ if $ad = bc$

and $\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$, $\frac{a}{b} + \frac{c}{d} = \frac{ad+bc}{bd}$.

w1w1

Preview

nod 1) 1) $\dfrac{-12(y^{-3}x^2)^{-2} y^7}{-6 z^{-2} (w+2)^0}$

2) $\dfrac{3}{4}(6v - 3) = -9$

3)   8 less than the qoutoint of a number and 7 is that same number remove 4

4) $(8x - 7)(6 - 2x)$

5) Solve for v ; $v^2 - 6v + 8 = 0$

Content

exponents

rules: 1) $a^{-n} = \dfrac{1}{a^n}$

2) $(a^b)^c = a^{bc}$

3) $a^b a^c = a^{b+c}$

4) $(ac)^b = a^b c^b$

5) $a^0 = 1 ; a \neq 0$

ex1) $\dfrac{((7x)^4)^2}{x^8}$

ex2) $\left(\dfrac{a}{b}\right)^{-m}$
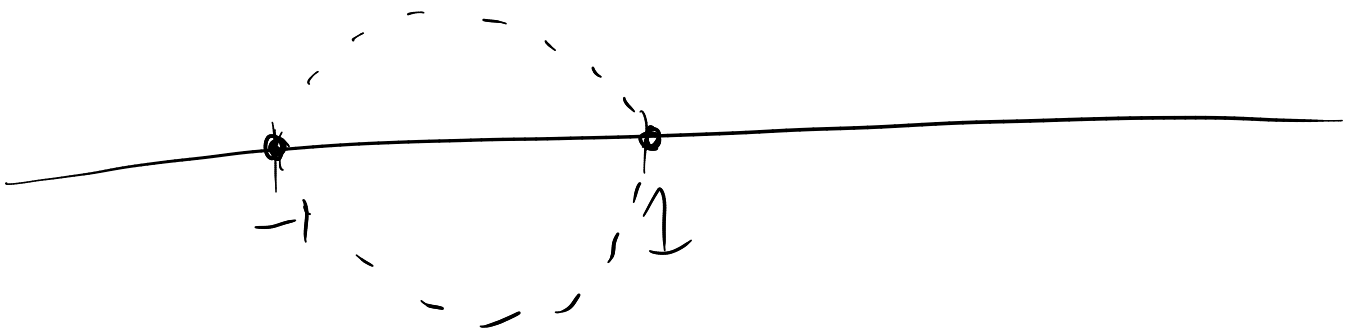
Groups of 3 do 1.2a
(split and check)

Abs Values

$|x|$ is distance x is from 0

$|x| = \sqrt{x^2}$
$\left\{ \text{if } x \text{ is point } (x_1, x_2, x_3) \right.$
$|x| = \sqrt{x_1^2 + x_2^2 + x_3^2}$

$|x| = 1 \rightarrow x = 1 \text{ or } -1$

1) $|ax| = |a||x|$

2) $|x| = 0 \Longleftrightarrow x = 0$

3) $|\cdot| : \mathbb{R} \longrightarrow [0, \infty)$ — later makes sense

4) $|expr| = pos$

     iff $\quad expr = pos$ or $expr = -pos$

     ex) $|7x + 4| = 3$

         then $7x + 4 = 3$ or $7x + 4 = -3$

5) $|x| \geq 0$, so $\qquad$ $|-2x + 1| = -4$ has no solution

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Different groups of 3 do 1.26 likewise.

Friday Start ↗

Today: Factoring

(P)review.

1) Solve for u; $|6u - 12| - 3 = -2$

2) find x, y intercepts for $25x^2 + 81y^2 = 16$

3) a) line through $(1,2)$ and $(4,3)$ w1F2

b) line parellel to (a) through $(-1, 3)$

c) line $\perp$ to (b) through (π, π)

4) You have 6000 USD in a 529.
After 24 years, you'll need

50,000 USD.

a) End amount = ___ X initial amount.

b) (ways off) What interst rate
do you need assuming annual rate?

5) I walk 5 miles from home,
stop for a bit, then run further
away.

a) graph my displacement

b) Graph my speed.

Content : Factoring

Case monic:

examine

$$(x+a)(x+b) = x^2 + (a+b)x + ab$$

So given $x^2 + cx + d$, need find

a, b s.t. $ab = d$ and $c = a+b$.

ex) $x^2 + 4x + 3$

$\wedge$

3 | $\overset{+}{\to} 4$

$(x+3)(x+1)$

Case not monic : $Ax^2 + Bx + C$

take $A \cdot C$

$\overset{(\cdot)}{d \quad e} \overset{+}{\to} B$

then, $Ax^2 + (d+e)x + C$

hope to regroup.

ex)

$$6x^2 + 8x + 2$$

$$= 2(3x^2 + 4x + 1)$$

$$= 2(3x^2 + (3+1)x + 1)$$

$$= 2(3x^2 + 3x + x + 1)$$

$$= 2((x+1)3x + (x+1) \cdot 1)$$

$$= 2(x+1)(3x+1)$$

$3 \cdot 1 = 3$

$3 \quad 1 \not{\Rightarrow} 4$

Pairs: 1,3 ⅔.

extra time: slopes ⅓ 2.1a