

Real Quiz # 8 for Dr. Z.'s MathHistory

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Email DrZlinear@gmail.com as soon as I tell you (around 3:15pm)

Subject: q8

with an attachment called

q8FirstLast.pdf (e.g. q8PaulErdos.pdf)

1. (2 points) What is Laplace's partial differential equation? Who derived it before Laplace?

$$\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} + \frac{\partial^2 v}{\partial z^2} = 0, \text{ Euler}$$

2. (2 points) What is the name of the city where Carl Friedrich Gauss was born? What was the occupation of his father?

Brunswick, day laborer

3. (2 point) Can the side-length of a regular polygon of 17 sides (inscribed in a circle of radius 1) be constructed with compass and ruler alone? Who proved (or disproved) it?

Yes, Gauss proved it in "Disquisitiones arithmeticae"

4. (4 points altogether)

Consider the set

$$G = \{0, 1, 2, 3, 4, 5\}$$

where the "multiplication", let's call it "\*", is addition modulo 6, for example:  $2 * 3 = 5$ ,  $4 * 5 = 3$ .

- a (1 point) Show that it is a group.

$G$  is a group because it is closed under the set.

$G$  is associative  $\rightarrow (1 * 2) * 3 = 0 = 1 * (2 * 3)$

$G$  has an identity = 0

$G$  has an inverse  $(3 * 3) = 0, 4 * 2 = 0$ .

- b (1 point) Is the subset  $\{1, 3, 5\}$  of  $G$  a subgroup of  $G$ ? Explain!

No,  $0 \notin \{1, 3, 5\}$  and is therefore not a group.

c (1 point) Show that  $H = \{0, 2, 4\}$  a subgroup of  $G$ .

$H \subseteq G$ , so is associative like  $G$ .

$H$  has identity,  $e = 0$ .

$H$  has inverse  $2 * 4 = 0$

d (1 point) Find the coset decomposition of  $G$  with respect to  $H$ .

Let  $a = 1$

$a \in G = \{0, 1, 2, 3, 4, 5\}$

$G = H \cup H * a$ .