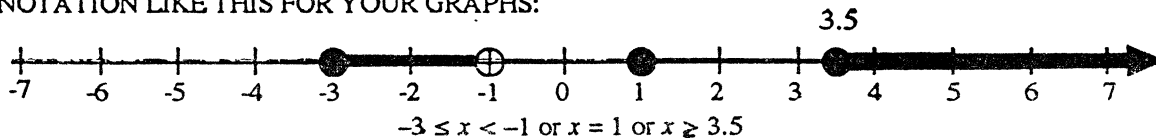


ROUND I: Graphing on the number line - inequalities, absolute value

DRAW THE GRAPH FOR EACH PROBLEM ON THE NUMBER LINE PROVIDED.

SPECIFY ANY NON-INTEGER ENDPOINTS.

USE NOTATION LIKE THIS FOR YOUR GRAPHS:

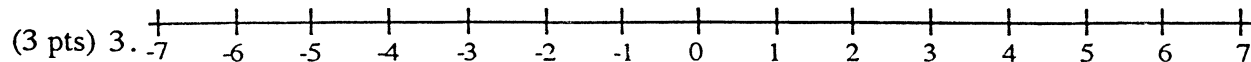
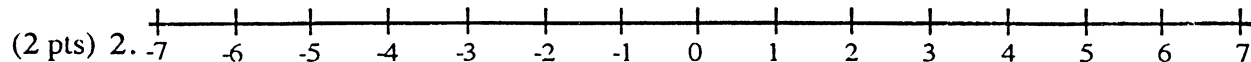
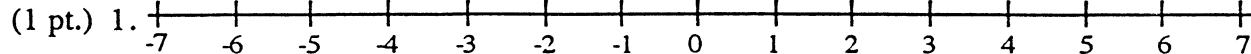


1. $300 - 200x < 500$

2. $7 - 3|4y - 7| \geq 4$

3. $1 < |z| \leq 3$

ANSWERS



ROUND II: Set theory

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. Two sets of people combined total 200. Of these 200, 145 belong to both sets. One of the sets has 170 people in it. How many people are in the other set?

2. A set G consists of all possible elements of the form $\{a,b,c\}$ where $a \in \{0,4,8\}$, $b \in \{w,x,y,z\}$ and $c \in \{\beta,\varphi,\theta,\mu,\chi\}$. How many elements are in set G ?

3. In a recent survey, 3 people used all of soap, fabric softener, and bleach, 6 people used only soap and softener, 12 used only soap, 10 used only softener, 11 used only bleach, the same number of people used just soap and bleach as used just softener and bleach, and 27 of the 75 people surveyed never did laundry. How many of those surveyed used softener and bleach only?

ANSWERS

(1 pt) 1. _____

(2 pts) 2. _____

(3 pts) 3. _____

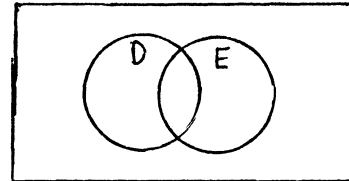
Doherty, South, Westborough

TEAM ROUND: Topics of previous rounds and open

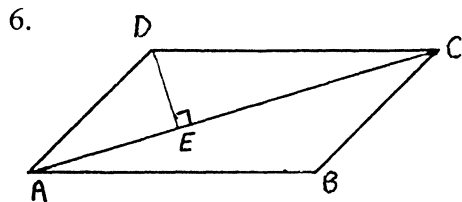
ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM AND ON THE SEPARATE
TEAM ROUND ANSWER SHEET 3 POINTS EACH

1. Graph the set of just the integers that satisfy $4 - |2x - 5| \geq x$. You must also supply relevant coordinates.

2. On the Venn diagram like this on the answer sheet shade $(\overline{D} \cup [D \cap E])$, where \overline{S} denotes the complement of set S.

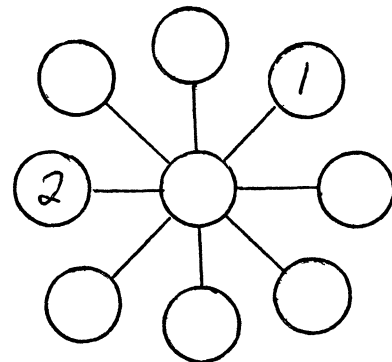


3. A tank at a marine exhibit contains 2000 gallons of sea water. The sea water is 7.5% salt. To the nearest gallon, how many gallons of fresh water must be added to the tank so that the mixture is 7% salt? Assume that the tank has room for the extra water.
4. In a single toss of two ordinary dice, what is the probability that neither doubles (two of the same number) nor a 5 will appear? Express your answer as a reduced fraction.
5. Find the sum of the prime factors of 2010 and the first prime year in the new millenium.

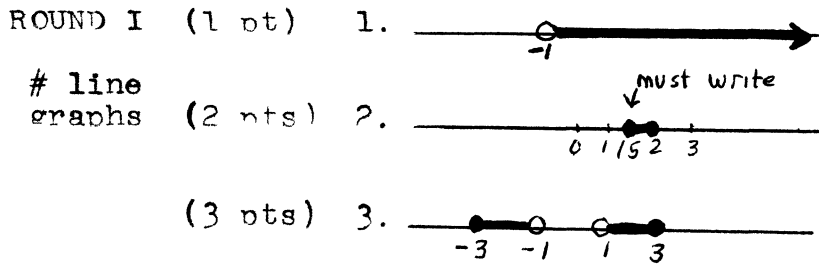


If the area of parallelogram ABCD is 64 and length $AC = 8$, find length DE if $\overline{DE} \perp \overline{AC}$.

7. Place each of the integers 3 through 9 in one of these circles in such a way that the sum of the numbers in each set of three collinear circles is 15.



8. If the volume of a cube is doubled in forming a larger cube, by what percent is each edge of the cube increased? Get the nearest 0.01%.



ROUND II (1 pt) 1. 175

sets (2 pts) 2. 60

(3 pts) 3. 3

ROUND III (1 pt) 1. 360,467

fr, dec (2 pts) 2. $\frac{54}{91}$

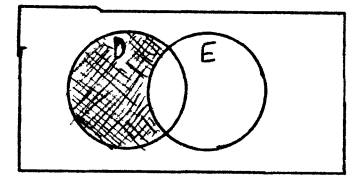
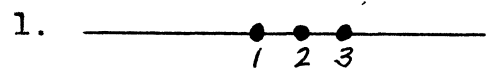
(3 pts) 3. 4.8 or $4\frac{4}{5}$ m

ROUND IV (1 pt) 1. $\frac{1}{8}$ or .125 or 12.5%

counting prob (2 pts) 2. 4662

(3 pts) 3. 132,300

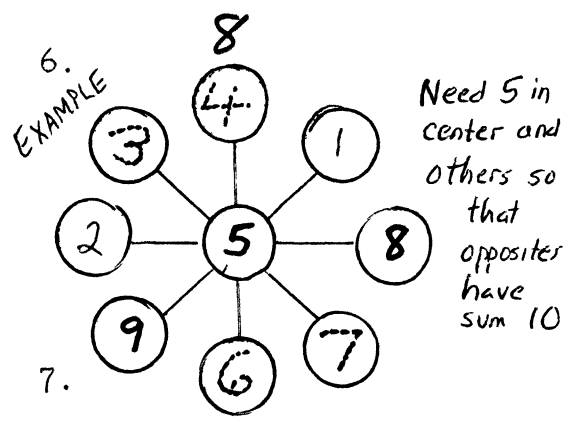
TEAM ROUND 3 pts each



3. 143 gal

4. $\frac{5}{9}$

5. 2080

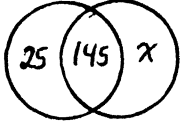


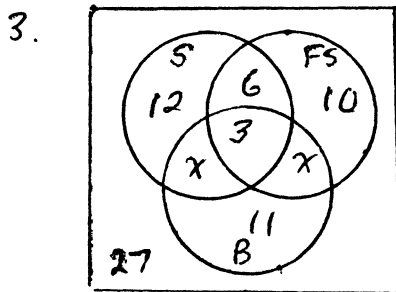
8. 25.99%

ROUND I

1. $3 - 2x < 5$
 $-2x < 2$
 $x > -1$
2. $-3|4y - 7| \geq -3$
 $|4y - 7| \leq 1$
 $4y - 7 \leq 1$ and $4y - 7 \geq -1$
 $y \leq 2$ and $y \geq \frac{3}{2} \Rightarrow \frac{3}{2} \leq y \leq 2$
3. $1 < z \leq 3$ or $-3 \leq z < 1$
 by nature of abs value

ROUND II

1. 
 $170 + x = 200$
 $x = 30$
 Other set
 $145 + 30 = 175$
2. (3 possible items for a) timer
 (4 " b) timer
 (5 " c) = 60



$$3 + 6 + 12 + 10 + 11 + 2x = 75$$

$$2x = 6 \Rightarrow x = 3$$

ROUND III


1. 1980 pop = 148.89% of 1970 pop
 $536,700 = 1.4889x$
 nearest integer $x = 360,467$

ROUND III cont.

2. $\frac{12}{13} - \frac{3}{7} = \frac{84 - 39}{91} = \frac{45}{91}$
 $\frac{3}{7} + \frac{1}{3} \left(\frac{45}{91} \right) = \frac{3}{7} + \frac{15}{91} = \left(\frac{54}{91} \right)$
 OR weighted average
 $\frac{2}{3} \left(\frac{3}{7} \right) + \frac{1}{3} \left(\frac{12}{13} \right) = \dots = \frac{54}{91}$
3. $\frac{1}{2} + \frac{1}{3} \left(\frac{1}{2} \right) + \frac{1}{8} \left(\frac{1}{3} \right) = \frac{12 + 4 + 1}{24}$
 (remaining) (remaining)
 $\frac{2}{3}$
 $= \frac{17}{24} = \text{fraction of total ht}$

and when multiplied by the number of steps gives the number of steps climbed, an integer.
 If there are 24 steps, each 0.2 m high, total ht = $24(.2) \in 4.8 \text{ m}$
 With 48 or more steps, the total ht is too big


ROUND IV


1. $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$ or tree diagram
2.  with $\frac{1}{2}$ on each branch
3. $5C_2 \cdot 7C_3 \cdot 3C_1 \cdot 9C_4$
 $= 10 \cdot 35 \cdot 3 \cdot 126$
 $= 132,300$


TEAM ROUND

1. If $2x \geq 5$, $4 - 2x + 5 \geq x$
 $(x \geq 2\frac{1}{2})$ $9 \geq 3x \Rightarrow x \leq 3$
 $(x = 3, \text{ only})$

If $2x < 5$, $4 + 2x - 5 \geq x$
 $(x < 2\frac{1}{2})$ $x \geq 1$ $(x = 1, 2)$

2. DNE 

$\bar{D} \cup \bar{DNE}$ 

Complement of this is 

3. orig salt = final salt
 $x = \text{gal fresh water to add}$
 $.075(2000) = .07(2000 + x)$
 $150 = 140 + .07x$
 $x = 143$ nearest gal.

4. $6 \cdot 6 = 36$ equally likely outcomes.
 5 possible first numbers (1, 2, 3, 4, 6)
 and 4 possible second numbers.
 $5 \cdot 4 = 20$ and probab. = $\frac{20}{36} = \frac{5}{9}$

5. $2010 = 10 \cdot 201 = \underbrace{5 \cdot 2 \cdot 3 \cdot 67}_{\text{sum } 77}$
 First prime year is 2003
 $77 + 2003 = 2080$

6. $\Delta \text{ area} = \frac{1}{2} AC \cdot DE = \frac{1}{2} \square \text{ area}$
 $4 \cdot DE = 32$
 $DE = 8$

7. 5, $\frac{1}{3}$ of 15, must go in the central circle. Then pairs of opposites must have sum 10

8. Since % change is sought, suppose cubes have volumes 1 and 2. Then edges are 1 and $\sqrt[3]{2}$.
 $\sqrt[3]{2} = \frac{x}{100} (1)$
 $125.99 = x$
 $\sqrt[3]{2}$ is 125.99 % of 1
 Increase is 25.99 %