

ROUND I: Algebraic word problems

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. You borrowed your dad's truck twice. You filled the gas tank each time. First it was $\frac{1}{2}$ empty. The second time it was $\frac{1}{3}$ full. If you bought 35 gallons of gasoline total, how much gasoline does the truck's tank hold?
2. It's time for Joe to paint the ferris wheel at the park. The park stocks two paints that can be used, a paint with 20% oil and another with 35% oil. To give a quality but economical result, Joe wants to get 120 gallons with 30% oil. How much of each should he use?
3. A large sink has two faucets, A and B, and a drain. The drain empties the sink at the same rate that faucet A fills it. If the drain is closed and both faucets are turned on, the sink is filled in 5 minutes. If faucet A is turned off, faucet B is on, and the drain is open, the sink is filled in 20 minutes. Find the time required for each faucet separately to fill the sink.

ANSWERS

1. (1 pt) _____ *gal.*2. (2 pts) _____ *gal 20%* _____ *gal 35%*3. (3 pts) *A* _____*B* _____

Bartlertt, Doherty, North



ROUND II: Operations on polynomials

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. Simplify: $(11x^2 - 29x + 10) - [(5x^2 - 13x + 24) - (x^2 + 7x + 7)]$

2. Find the quotient when $2t^3 - 5t + 3$ is divided by $t - 1$.

3. First, if $(x-1)$ is a factor of $(x^2 - x - 1)$, then square $(x + 1)$; if not, then square $(x + 2)$.
Second, if $(x^4)^2 = x^6$, then multiply $(x + 1)(x - 1)$; if not square $(x - 1)$.
Then subtract the second result from the first one and write the difference as your answer.

ANSWERS

1. (1 pt) _____

2. (2 pts) _____

3. (3 pts) _____

ROUND III: Ratio, proportion, and variation

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM OR AS SPECIFIED IN THE PROBLEM

1. Stuck in stop and crawl traffic on the Mass Pike, I notice that I'm covering a distance of 3 miles in 20 minutes. At this rate how much longer will it take me to reach my exit, 21 miles further? Answer with a whole number of hours and the nearest integer number of minutes less than 60.

2. The stopping distance, d , of a car after the brakes are applied varies directly as the square of the speed. If a car traveling at 60 km/hr can stop in 80 meters, how many meters will it take the same car to stop when it is traveling at 90 km/hr?

3. The volumes of similar solids are in the ratio of their corresponding dimensions cubed. A cylinder 4 inches in diameter and 6 inches high holds 1 pound of oatmeal. To the nearest ounce, how much oatmeal will a similar 10 inch high cylinder hold? Give your answer as whole pounds and the nearest integer number of ounces less than 16 (like 2 pounds and 9 ounces). 1 pound = 16 ounces.

ANSWERS

1. (1 pt) _____

2. (2 pts) _____ *meters*

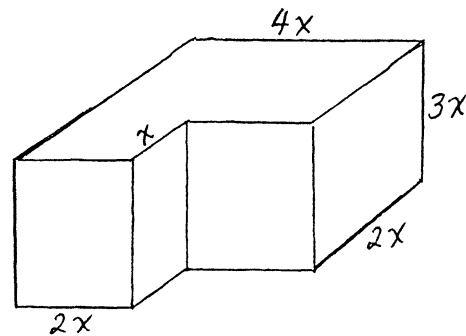
3. (3 pts) _____

ROUND IV: Perimeter, area, and volume

ALL ANSWERS MUST BE IN SIMPLEST EXACT FORM

1. The rectangular top of Jim's swimming pool is 10 feet longer than it is wide. If its perimeter is 64 feet, what is the area of the top of the pool?

2. Express the volume of the object shown in terms of x . All angles are right angles.



3. Todd and his brother have each agreed to mow half of the front lawn, which is a 65 ft by 128 ft rectangle. The mower cuts a 2.5 ft wide strip. If Todd starts at a corner and mows around the perimeter of the lawn and manages not to overlap a previously cut area, how many times must he mow all the way around until he has mowed at least his half?

ANSWERS

1. (1 pt) 59 ft

2. (2 pts) cubic units

3. (3 pts) _____

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 You lost your wallet after making two purchases and don't remember how much money you had, but you remember thinking that your first purchase cost 10% of what you had. Then you noticed that the second purchase was also 10% of what you had left. Your sales slips totaled \$19. How much money was in your wallet when you lost it?

2. Factor completely: $e^{2x+1} - 4e^{2y+1}$

3. If 120 is divided into three parts which are proportional to 1 , $\frac{1}{2}$, and $\frac{1}{6}$, what is the middle part?

4. In square WXYZ, the midpoints of \overline{WZ} and \overline{YZ} are connected to one another and to point X, creating four non-overlapping triangles. How many times larger is the area of the largest triangle than the smallest?

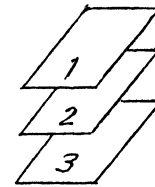
5. A queen is just below a queen.

A jack is just above a queen.

A spade is just above a spade.

A heart is just below a spade.

Name the three cards by type and suit, like "queen of hearts".



6. Solve for x in terms of a : $\frac{x}{2} + \frac{5}{a} = \frac{3}{7}$. The answer involves fractions. Express it as a single fraction.

7. Four numbers are written in a row. The average of the first two numbers is 7, the average of the middle two is 2.3, and the average of the last two is 8.4. What is the average of the first and last numbers?

8. An elevator went from the bottom to the top of a skyscraper at an average speed of 3 ft/sec, remained at the top for 2.5 minutes, and then returned to the bottom at an average of 4 ft/sec. If the total elapsed time was 11.25 minutes, how high is the building? Disregard the height of the elevator and any roof extensions.

- ROUND I
alg
word
prob
1. (1 pt) 30 gal.
 2. (2 pts) 40 gal 26% 80 gal 35%
 3. (3 pts) A $13\frac{1}{2}$ min B 8 min
or 13 min 20 sec Need units

- ROUND II
poly
oms
1. (1 pt) $7x^2 - 9x - 7$
 2. (2 pts) $2t^2 + 2t - 3$
 3. (3 pts) $6x + 3$

- ROUND III
ratio
prop
var
1. (1 pt) 2 hrs 20 min
 2. (2 pts) 180 meters
 3. (3 pts) 4 pounds and 10 ounces
abbreviations OK

- ROUND IV
perim
area
vol
1. (1 pt) 231 sq ft
 2. (2 pts) $30x^3$
 3. (3 pts) 5

TEAM ROUND 3 pts each

1. \$ 81
2. $e(e^x + 2e^y)(e^x - 2e^y)$
3. 36
4. 3
5.
 - 1 jack of spades
 - 2 queen of spades
 - 3 queen of hearts
6. $\frac{6a - 70}{7a}$ OR factored
7. 13.1
8. 900 ft
↑
needed

ROUND I

1. $\frac{1}{2}x + \frac{2}{3}x = 35$

$\frac{7}{6}x = 35 \Rightarrow x = 30$

2. Use x 20% and $120-x$ 35%.

$.20x + .35(120-x) = .30(120)$

$20x + 4200 - 35x = 3600$

$600 = 15x \Rightarrow x = 40$

\therefore 40 gal 20% and 80 gal 35%.

3. Let a, b be times for A, B to fill.
Rates of filling are $\frac{1}{a}$ and $\frac{1}{b}$.

$5\left(\frac{1}{a} + \frac{1}{b}\right) = 1$ and $20\left(\frac{1}{b} - \frac{1}{a}\right) = 1$

$$\begin{cases} \frac{20}{a} + \frac{20}{b} = 4 \\ -\frac{20}{a} + \frac{20}{b} = 1 \end{cases}$$

$\frac{40}{b} = 5 \Rightarrow b = 8 \text{ min}$

$\frac{5}{a} + \frac{5}{8} = 1$

$\frac{5}{a} = \frac{3}{8} \Rightarrow a = \frac{40}{3} = 13\frac{1}{3} \text{ min}$

ROUND II

1. $(11x^2 - 29x + 10) - (4x^2 - 20x + 17)$
 $= 7x^2 - 9x - 7$

2.
$$\begin{array}{r} 2t^2 + 2t - 3 \\ t-1 \overline{) 2t^3 - 5t + 3} \\ \underline{2t^3 - 2t^2} \\ 2t^2 - 5t \\ \underline{2t^2 - 2t} \\ -3t + 3 \\ \underline{-3t + 3} \\ 0 \end{array}$$

3. 1st no. 50 $x^2 + 4x + 4$
2nd no. 50 $x^2 - 2x + 1$
Ans : $6x + 3$

ROUND III

1. $\frac{3 \text{ mi}}{20 \text{ min}} = \frac{21 \text{ mi}}{x \text{ min}}$

$3x = 21 \cdot 20$

$x = 140 \text{ min} = 120 + 20 \text{ min}$
 $= 2 \text{ hrs, } 20 \text{ min}$

2. $d = Ks^2$

$80 = K \cdot 3600 \Rightarrow K = \frac{80}{3600} = \frac{1}{45}$

$d = \frac{1}{45} \cdot 90^2 = 180 \text{ m}$

3. $\frac{1}{x} = \left(\frac{6}{10}\right)^3$

$x = \frac{125}{27} = 4.6296... \text{ pounds}$

$.6296 \text{ lb} \left(\frac{16 \text{ oz}}{\text{lb}}\right) = 10.07... \text{ oz}$

Thus 4 pounds, 10 ounces

ROUND IV

1. $2(w+w+10) = 64$

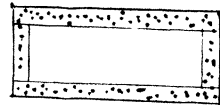
$2w+10 = 32 \Rightarrow w = 11 \text{ ft}$

Area = $11 \cdot 21 = 231 \text{ sq ft}$

2. $2x \cdot x \cdot 3x + 4x \cdot 2x \cdot 3x$

$= 6x^3 + 24x^3 = 30x^3$

3. Whole area = $65 \cdot 128 = 8320$, so he must mow at least 4160 ft^2 .



| time around | area mowed that time | total |
|-------------|----------------------------------|-------|
| 1 | $128(2.5)(2) + 60(2.5)(2) = 940$ | 940 |
| 2 | $123(25)(2) + 55(25)(2) = 890$ | 1830 |
| 3 | $118(5) + 50(5) = 840$ | 2670 |
| 4 | $113(5) + 45(5) = 790$ | 3460 |
| 5 | $108(5) + 40(5) = 740$ | 4200 |