

**Easy – The I guess I won't be going to Harvard level.**

1. If  $x - 5 = 15$  then what is the value of  $2x$ ?
  - a) 10
  - b) 20
  - c) 40
  - d) 100
  - e) 200

**Medium 450 – 500**

2. If  $x$  and  $y$  are prime numbers, and the average (arithmetic mean) of  $x$  and  $y$  is 14, then  $x$  could be which of the following?
  - a) 2
  - b) 3
  - c) 7
  - d) 11
  - e) 13

**Difficult 650+**

3. Series  $T$  is a sequence of numbers where each term after the first term is  $x$  greater than the term that precedes it. If the sum of the first and last term of series  $T$  is 14, then what is the sum of the first three terms of series  $T$  and the last three terms of series  $T$ ?
  - a) -7
  - b) 7
  - c) 14
  - d) 42
  - e) 84

## How to attack the Problems

LOGIC

APPROXIMATION

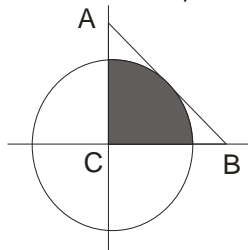
ERROR IDENTIFICATION

INSERTING

BACK SOLVING

SCHOOL METHODS

4. In the figure below triangle ABC is drawn tangent to the circle. If triangle ABC is an isosceles right triangle with an area of 4, what is the area of the shaded region of the circle within the area of the triangle?

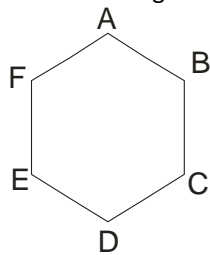


- a)  $\pi$
- b)  $2\pi$
- c)  $2\pi\sqrt{2}$
- d)  $4\pi$
- e)  $8\pi$

5. If the area of a square is 80, then what is the area of the largest circle that could fit within the area of the square?

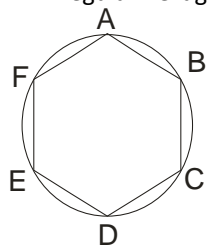
- a)  $10\pi$
- b)  $20\pi$
- c)  $25\pi$
- d)  $40\pi$
- e)  $80\pi$

6. The hexagon ABCDEF is regular. Each side of the hexagon is 2 feet. What is the area of rectangle BCEF?



- a) 4 square feet
- b)  $4\sqrt{3}$  square feet
- c) 8 square feet
- d)  $4 + 4\sqrt{3}$  square feet
- e) 12 square feet

7. Regular hexagon ABCDEF is inscribed in a circle with area  $16\pi$ . What is the area of hexagon ABCDEF?



- a) 4
- b)  $6\sqrt{3}$
- c)  $12\sqrt{2}$
- d)  $24\sqrt{3}$
- e)  $48\sqrt{2}$

## Approximation

8. A computer salesman sells an average of 15 computer systems a month at \$4,200 per system. He earns a basic salary of \$22,000 per year plus a commission of 7.5% on monthly sales made over a level of \$25,000 per month. What is his expected annual income?
- a) \$78,700
  - b) \$75,200
  - c) \$66,700
  - d) \$56,200
  - e) \$34,200
9. From 1985 to 1995, the population of Jamestown increased by 50%, and from 1995 to 2005, the population increased by 200% to 13,284. The population in 2005 was how much greater than the population in 1985?
- a) 2,952
  - b) 4,428
  - c) 7,971
  - d) 8,856
  - e) 10,332

## Inserting

The general case

- When they give you a variable, but they don't ask for its value then inserting could be the way to go.
- When you see variables in the answer choices insert first.

10. It costs 10 cents a kilometer to fly and 12 cents a kilometer to drive. If you travel 200 kilometers, flying  $x$  kilometers of the distance and driving the rest, then the cost of the trip in dollars is?

- a) 20
- b) 24
- c)  $24 - 2x$
- d)  $24 - 0.02x$
- e)  $2,400 - 2x$

11. When ticket sales began, Pat was the  $n$ th customer in line for a ticket, and customers purchased their tickets at the rate of  $x$  customers per minute. Of the following, which best approximates the time, in minutes, that Pat had to wait in line from the moment ticket sales began?

- a)  $(n - 1)x$
- b)  $n + x - 1$
- c)  $\frac{n - 1}{x}$
- d)  $\frac{n - 1}{n}$
- e)  $\frac{n}{x - 1}$

12. The  $R$  students in a class agree to contribute equally to buy their teacher a birthday present that costs  $y$  dollars. If  $x$  of the students later fail to contribute their share, which of the following represents the additional number of dollars that each of the remaining students must contribute in order to pay for the present?

- a)  $\frac{y}{R}$
- b)  $\frac{y}{R - x}$
- c)  $\frac{xy}{R - x}$
- d)  $\frac{xy}{R(R - x)}$
- e)  $\frac{y}{R(R - x)}$

13. If  $M$  and  $N$  are positive integers that have remainders of 1 and 3 respectively, when divided by 6. Which of the following could not be a possible value of  $M + N$ ?

- a) 86
- b) 52
- c) 34
- d) 28
- e) 10

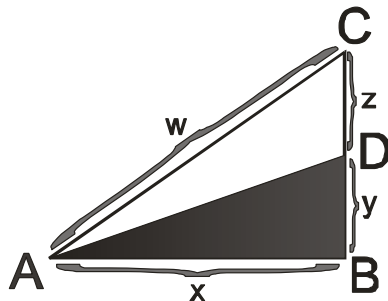
14. Mike and Nancy weigh a combined  $T$  pounds. Mike weighs 10 pounds more than Nancy. Their son Edward weighs  $T/4$  pounds more than Nancy. In terms of  $T$  what is Edward's weight in pounds?

a)  $(T/4) - 20$   
 b)  $(3T/2) - 5$   
 c)  $5T/4$   
 d)  $4T - 10$   
 e)  $(3T/4) - 5$

15. The length of two sides of a right triangle are  $d/3$  and  $d/4$ , where  $d > 0$ . If one of these sides is the hypotenuse, what is the length of the third side of the triangle?

a)  $\frac{5d}{12}$       b)  $\frac{d}{\sqrt{7}}$       c)  $\frac{d}{5}$       d)  $\frac{d}{12}$       e)  $\frac{d\sqrt{7}}{12}$

16. If the shaded area is one half the area of the triangle ABC and the angle ABC is a right angle, then the length of the line segment AD is?



a)  $\frac{w}{2}$       b)  $\frac{w+x}{2}$       c)  $\sqrt{2x^2+z^2}$       d)  $\sqrt{w^2-3y^2}$       e)  $\sqrt{y^2+z^2}$

## Inserting

How to deal with algebra...

17. If  $x \neq 3$ , then

$$\frac{3x(x-3)-x+3}{x-3}=?$$

- a)  $x + 1$
- b)  $x - 3$
- c)  $3x + 1$
- d)  $3x - 1$
- e)  $3x + 3$

18. Which of the following is equivalent to  $\frac{2x+4}{2x^2+8x+8}$  for all values of  $x$  for which both expressions are defined?

- a)  $\frac{1}{2x^2+6}$
- b)  $\frac{1}{9x+2}$
- c)  $\frac{2}{x+6}$
- d)  $\frac{1}{x+4}$
- e)  $\frac{1}{x+2}$

19. If  $n > 4$ , which of the following is equivalent to  $\frac{n-4\sqrt{n}+4}{\sqrt{n}-2}=?$

- a)  $\sqrt{n}$
- b)  $2\sqrt{n}$
- c)  $\sqrt{n+2}$
- d)  $\sqrt{n-2}$
- e)  $n+\sqrt{n}$

20. If  $y \neq -7$ , then  $\frac{y^3+5y^2-15y-7}{y+7}=?$

- a)  $y^2-5y+1$
- b)  $y^2-2y-1$
- c)  $y^2+5y-15$

- d)  $2y^2 - 3y - 1$   
e)  $2y^2 - 5y + 1$

## Inserting

### How to deal with Ratios

- When you are asked for a ratio, fraction or percentage inserting could be the way to go.
- Think about the Least Common Multiple (LCM)

21. If one tic equals 3 tacs and 2 tacs equals 5 tocs, what is the ratio of one tic to one toc?

- a) 15 : 2  
b) 2 : 15  
c) 6 : 5  
d) 5 : 6  
e) 1 : 15

22. If  $a = 2b$ ,  $\frac{1}{2}b = c$ , and  $4c = 3d$ , then what is the ratio of  $d$  to  $a$ ?

- a) 1 : 3  
b) 3 : 1  
c) 3 : 4  
d) 1 : 1  
e) 4 : 3

### How to deal with Fractions

- When you are asked for a ratio, fraction or percentage inserting could be the way to go.
- Think about the Least Common Multiple (LCM)

23. If a vender sells  $\frac{2}{5}$  of his goods in the morning and  $\frac{1}{3}$  of the remaining goods in the afternoon, what fraction of his goods did he sell in the morning and afternoon combined?

- a)  $\frac{3}{8}$   
b)  $\frac{2}{5}$   
c)  $\frac{3}{5}$   
d)  $\frac{2}{3}$   
e)  $\frac{11}{15}$

24. If  $\frac{1}{2}$  of the number of white mice in a certain laboratory is  $\frac{1}{8}$  of the total number of mice, and  $\frac{1}{3}$  of the number of gray mice is  $\frac{1}{9}$  the total number of mice, then what is the ratio of white mice to gray mice in the laboratory?

- a) 16:27  
b) 2:3  
c) 3:4  
d) 4:3  
e) 3:2

## Inserting

How to deal with Percents

- When you are asked for a ratio, fraction or percentage inserting could be the way to go.
- Think 10 or 100

25. Last year a certain store made a 10 percent profit on all sales. This year sales are 20 percent higher than last year, but the store's profits are only 5 percent of sales. This year's profits are what percent of last year's profits?
- a) 60%
  - b) 80%
  - c) 100%
  - d) 120%
  - e) 140%
26. In the first half of the 20th century, the population of a particular country increased by 200 percent. In the second half of the century the population increased by 300 percent. What was the percent increase for the 20th century as a whole?
- a) 500%
  - b) 600%
  - c) 800%
  - d) 1100%
  - e) 1200%

$$\frac{d^2w}{n}$$

27. If the time it takes a company to build a dam is determined by the formula  $\frac{d^2w}{n}$ , where d is the depth of the dam in meters, w is the width in meters, and n is the number of employees involved, and the plans for a certain dam are changed so that the depth increases by 20 percent, the width decreases by 30 percent, and the number of employees increases by 40 percent, what will be the percent change in the time required to build the dam?
- a) - 40%
  - b) - 28%
  - c) + 15%
  - d) + 30%
  - e) + 78%
28. In a class of 350 students 60% are men, of whom 30% swim. If 40% of all the students swim, what % of the women does not swim?
- a) 18%
  - b) 22%
  - c) 30%
  - d) 45%
  - e) 55%



## Error Identification and the Unit Method

29. If Mike travels at a constant speed of  $x$  miles in  $y$  hours, how long will it take him to travel  $z$  miles?

$$\frac{xy}{z}$$
 a) 
$$\frac{zy}{x}$$
 b) 
$$\frac{y}{xz}$$
 c) 
$$\frac{x}{zy}$$
 d) 
$$\frac{z}{xy}$$
 e)

30. David can sail  $m$  miles in 13 hours. At that constant rate, how many hours will it take to sail  $n$  miles?

$$\frac{mn}{13}$$
 a) 
$$\frac{13}{mn}$$
 b) 
$$\frac{13m}{n}$$
 c) 
$$\frac{13n}{m}$$
 d) 
$$\frac{m}{13n}$$
 e)

31. If snow falls at a rate of  $x$  centimeters per minute, how many hours would it take for  $y$  centimeters to fall?

$$\frac{x}{60y}$$
 a) 
$$\frac{y}{60x}$$
 b) 
$$\frac{60x}{y}$$
 c) 
$$\frac{60y}{x}$$
 d) 
$$60xy$$
 e)

32. If  $n$  identical pipes can fill an  $x$ -gallon pool in  $t$  hours, then at the same rate how long will it take one such pipe to fill a  $y$ -gallon pool?

$$\frac{ty}{xn}$$
 a) 
$$\frac{nty}{x}$$
 b) 
$$\frac{n}{xyt}$$
 c) 
$$\frac{y}{xnt}$$
 d) 
$$\frac{xy}{nt}$$
 e)

33. If a publishing company prints books at a constant rate of  $b$  books in  $m$  minutes, how long will it take to print 10000 books with  $p$  amount of presses in hours? (no answer choices what goes on top of the fraction bar and what goes on the bottom)

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## Algebra revisited with Back Solving.

34. Evaluate the following:

$$\frac{9506}{97}$$

- a) 95
- b) 96
- c) 97
- d) 98
- e) 99

$$\frac{3x(x-3)-x+3}{x-3}=?$$

35. If  $x \neq 3$ , then

- a)  $x + 1$
- b)  $x - 3$
- c)  $3x + 1$
- d)  $3x - 1$
- e)  $3x + 3$

$$\frac{n-4\sqrt{n+4}}{\sqrt{n-2}}=?$$

36. If  $n > 4$ , which of the following is equivalent to

- a)  $\sqrt{n}$
- b)  $2\sqrt{n}$
- c)  $\sqrt{n+2}$
- d)  $\sqrt{n-2}$
- e)  $n+\sqrt{n}$

37. If  $y \neq -7$ , then

$$\frac{y^3+5y^2-15y-7}{y+7}=?$$

- a)  $y^2-5y+1$
- b)  $y^2-2y-1$
- c)  $y^2+5y-15$
- d)  $2y^2-3y-1$
- e)  $2y^2-5y+1$

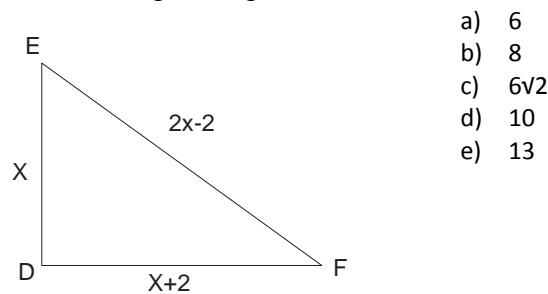


## Back Solving

When they give you a variable, and ask for its value then back solving could be the way to go...

38. Four friends live together in an apartment and split the monthly rent equally. When one of the friends moves out, the remaining three split the rent equally and each pays \$50 per month more than before. How much is the total monthly rent for the apartment?
- a) \$240
  - b) \$360
  - c) \$480
  - d) \$600
  - e) \$800
39. A salesman is paid \$5.00 per hour for every hour he works in the office and \$8.00 for every hour he spends on the road. If he worked twice as many hours in the office as worked on the road, and he earned \$360 during a certain week, then how many hours did the salesman work in the office during the week?
- a) 20
  - b) 40
  - c) 50
  - d) 60
  - e) 70
40. A car dealer had a sale in order to sell off excess stock. Before the sale, the dealer had three times as many cars as he had trucks. During the sale, he sold 100 cars and 25 trucks. If after the sale the dealer has twice as many cars as trucks, then how many cars did the dealer have prior to the sale?
- a) 60
  - b) 90
  - c) 120
  - d) 150
  - e) 180

41. In the right triangle DEF below, what is the value of  $x$ ?



- a) 6
  - b) 8
  - c)  $6\sqrt{2}$
  - d) 10
  - e) 13
42. Philip has twice as many salamanders as Matt. If Philip gives Matt 10 of his salamanders, he will have half as many as Matt. How many salamanders do Philip and Matt have together?
- a) 10
  - b) 20
  - c) 30
  - d) 40
  - e) 60

43. An angle of  $x$  degrees has the property that its complement is equal to  $\frac{1}{6}$  of its supplement where  $x$  is?
- a) 30 degrees
  - b) 45 degrees
  - c) 60 degrees
  - d) 63 degrees
  - e) 72 degrees
44. A wire is cut into three equal parts. The resulting segments are then cut into 4, 6 and 8 equal parts respectively. If each of the resulting segments has an integer length, what is the minimum length of the wire?
- a) 24
  - b) 36
  - c) 48
  - d) 54
  - e) 72
45. A store has a parking lot that contains 70 parking spaces. Each row in the parking lot contains the same number of parking spaces. The store has bought additional property in order to build an addition to the store. When the addition is built, 2 parking spaces will be lost from each row; however 4 more rows will be added to the parking lot. After the addition is built the parking lot will still have 70 parking spaces, and each row will contain the same number of parking spaces as every other row. How many rows were in the parking lot before the addition was built?
- a) 5
  - b) 6
  - c) 7
  - d) 10
  - e) 14
46. It takes an hour more by train to cover a distance of 360 miles when the usual speed of the train is decreased by 4 mph. What is the usual speed of the train?
- a) 60
  - b) 55
  - c) 50
  - d) 45
  - e) 40
47. A certain used-book dealer sells paperback books at 3 times dealer's cost and hardback books at 4 times dealer's cost. Last week the dealer sold a total of 120 books, each of which had cost the dealer \$1. If the gross profit (sales revenue minus dealer's cost) on the sale of all of these books was \$300, how many of the books sold were paperbacks?
- a) 40
  - b) 60
  - c) 75
  - d) 90
  - e) 100

48. A merchant paid \$300 for a shipment of  $x$  identical calculators. The merchant used 2 of the calculators as demonstrators and sold each of the others for \$5 more than the average (arithmetic mean) cost of the  $x$  calculators. If the total revenue from the sale of the calculators was \$120 more than the cost of the shipment, how many calculators were in the shipment?
- a) 24
  - b) 25
  - c) 26
  - d) 28
  - e) 30
49. A car traveled 462 miles per tank full of gasoline on the highway and 336 miles per tank full of gasoline in the city. If the car traveled 6 fewer miles per gallon in the city than on the highway, how many miles per gallon did the car travel in the city?
- a) 14
  - b) 16
  - c) 21
  - d) 22
  - e) 27
50. A total of \$ 30,000 invested in two investments yields 4.5% and 6% simple interest. If the total interest at the end of the year was \$ 1,470, how much was invested at the higher rate?
- a) \$ 8,000
  - b) \$ 14,000
  - c) \$ 17,500
  - d) \$ 22,000
  - e) \$ 25,650