

## Basic Arithmetic Concepts

Date \_\_\_\_\_

Page \_\_\_\_\_

1) For how many positive integers, 'a', is it true that  $a^2 \leq 2a$ ?

2) If  $0 < a < b < 1$ , which of the following is (are) true?

1)  $a-b$  is -ve    2)  $\frac{1}{ab}$  is true    3)  $\frac{1}{b} - \frac{1}{a}$  is true

3) If 'a' and 'b' are negative, and 'c' is positive, which of the following is (are) true

I.  $a-b < a-c$

II. If  $a < b$ , then  $\frac{a}{c} < \frac{b}{c}$

III.  $\frac{1}{b} < \frac{1}{c}$

4) At 3:00 am the temperature was 13° below zero. By noon, it had risen to 32°C. What was the average hourly increase in temperature?

5) If  $(7^a)(7^b) = \frac{7^c}{7^d}$ , what is 'd' in terms of a, b, and c?

6) If 'p' and 'q' are primes greater than 2, which of the following must be true?

I.  $p+q$  is even

II.  $pq$  is odd

III.  $p^2 - q^2$  is even

Qs 7 and 8 refer to the following definition.

For any positive integer  $n$ ,  $\tau(n)$  represents the number of positive divisors of  $n$ .

7. Which of the following is (are) true?

I.  $\tau(5) = \tau(7)$

II.  $\tau(5) \cdot \tau(7) = \tau(35)$

III.  $\tau(5) + \tau(7) = \tau(12)$

8. What is the value of  $\tau(\tau(\tau(12)))$ ?

9. Which of the following is equal to  $(7^3 \times 7^9)^{10}$ ?

10. If  $x \oslash y$  represents the number of integers greater than  $x$  and less than  $y$ , what is the value of  $-\pi \oslash \sqrt{2}$ ?

11. If  $0 < x < 1$ , in terms of  $\sqrt{x}$ ,  $x^2$  and  $x$ , the increasing order would be?

12. At Ben's Butcher Shop 99 pounds of chopped meat is being divided into packages each weighing 2.5 pounds. How many <sup>pounds</sup> ~~pounds~~ of meat are left when there isn't enough to make another whole package?

13. Maria has two electronic beepers. One of them beeps every 4 seconds, the other beeps every 9 seconds. If they are turned on exactly the same time, how

ts the

many times during the next hour will both beepers beep at the same time?

14. If  $-7 \leq x \leq 7$  and  $0 \leq y \leq 12$ , what is the greatest possible value of  $y - x$ ?

15. If an integer less than 1,000 that has a remainder of 1 when it is divided by 2, 3, 4, 5, 6, or 7, what is one possible value of  $x$ ?

16. What is the value of  $2^4 \div 2^{-4}$ ?

17. What is the value of  $|(-2-3) - (2-3)|$ ?

18. For any integer,  $a$ , greater than 1, let  $\uparrow a \downarrow$  be the greatest prime factor of  $a$ . What is  $\uparrow 132 \uparrow$ ?

19. If the product of four consecutive integers is equal to one of the integers, what is the largest possible value of one of the integers?

20. If  $x$  and  $y$  are positive integers and  $(13^x)^y = 13^{13}$ , what is the average of  $x$  and  $y$ ?

21. A French class has 12 boys and 18 girls. Boys are what fraction of the class.

22. For how many integers,  $a$ , between 30 and 40 is it true that  $\frac{5}{a}$ ,  $\frac{8}{a}$ , and  $\frac{13}{a}$  are all in lowest terms?

$3 \times 7^9$   $^{10}$ ?

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23. ✓  $\frac{1}{4}$  is the average of  $\frac{1}{5}$  and what number?

24. If  $\frac{3}{11}$  of a number is 22, what is  $\frac{6}{11}$  of that number?

25. ✓ What fractional part of a week is 98 hours?

26.  $\frac{5}{8}$  of 24 =  $\frac{15}{7}$  of what number?

27. ✓ Which of the following is (are) greater than  $x$ , when  $x = \frac{9}{11}$ ?

I.  $\frac{1}{x}$

II.  $\frac{x+1}{x}$

III.  $\frac{x+1}{x-1}$

28. ✓ If  $a = 0.99$ , which of the following is (are) less than  $a$ ?

I.  $\sqrt{a}$

II.  $a^2$

III.  $\frac{1}{a}$

number?

29. For the final step in a calculation, Paul accidentally divided by 1000 instead of multiplying by 1000. What should he do to correct his answer?

that

30. One day at Doon School,  $\frac{1}{12}$  of the students were absent, and  $\frac{1}{5}$  of those present went on a field trip. If the number of students staying in school was 704, how many students are enrolled at Doon School?

ms?

31. What is a possible value of 'x' if  $\frac{3}{5} < \frac{1}{x} < \frac{7}{9}$ ?

r than

32. If  $7a = 3$  and  $3b = 7$ , what is the value of  $\frac{a}{b}$ ?

33. If  $A = \{1, 2, 3\}$ ,  $B = \{2, 3, 4\}$  and  $c$  is the set consisting of all the fractions whose numerators are in 'A' and whose denominators are in 'B', what is the product of all the numbers in  $c$ ?

are) less

34. Charlie bought a \$60 radio on sale at 5% off. How much did he pay, including 5% sales tax?

35. If 'a' is a positive number, 400% of a is what percent of 400a?

36. What percent of 50 is b?

✓ 37. At Harry's discount hardware everything is sold for 20% less than the price marked. If Harry buys tool kits for \$80, what price should he mark them if he wants to make a 20% profit on his cost?

38. 9 is  $\frac{1}{3}\%$  of what number?

✓ 39. James was planning on depositing a certain amount of money each month into a college fund for his children. He foresaw that he could not deposit money in November and December. To make the same annual contribution that he had originally planned, by what % should he increase his monthly deposits?

✓ 40. During his second week on the job, Jason earned \$110. This represented a 25% increase over his earnings of the previous week. How much did he earn during his first week of work?

✓ 41. What is 10% of 20% of 30%?

42. On a test consisting of 80 questions, Marie answered 75% of the first 60 questions correctly. What % of the other 20 questions did she need to answer correctly for her grade on the entire exam to be 80%?

43. A jar contains 2000 marbles. If 61.5% of them are red, 27.2% of them are white, and 10% of them are blue, how many are neither red, white, nor blue?

44. If 25 students took an exam and 4 of them failed, what percent of them passed?

45. There are twice as many girls as boys in an English class. If 30% of the girls and 45% of the boys have already handed in their book reports, what % of the students have not yet handed in their reports?

46. During a sale a clerk was putting a new price tag on each item. On one radio, he accidentally raised the price by 15% instead of lowering the price by 15%. As a result the price on the tag was \$45 too high. What ~~was~~ was the original price, in dollars, of the radio?

47. If a person has an income of \$100,000, what % of his income does he pay in federal income tax if the tax rate is as given below?

15% of the first 30,000 income

28% of the next 30,000 income

31% of all income in excess of 60,000

48. The price of a can of soup was increased by 20%. How many cans can be purchased for the amount of money that used to buy 300 cans?

5.

5

✓ 49. An art dealer bought a painting for \$1000 and later sold it for \$10,000. By what % did the value of the painting increase?

5

✓ 50. Jar A has 20% more marbles than jar B. What percent of the marbles in jar A have to be moved to jar B, in order that the number of marbles in each jar will be same?

51. Wendy drew a square. She then erased it and drew a second square whose sides are 3 times the sides of the first square. The area of the second square is  $K\%$  greater than the area of the first square. What is  $K$ ?

5

5

5

✓ 52. In a large jar full of jelly beans, 30% of them are red, and 40% of the red jelly beans are cherry. If 25% of the non-cherry flavored red jelly beans are raspberry, what % of all the jelly beans are either cherry or raspberry?

50

60

61.



53. If  $\frac{2}{3}$  of the workers in an office are non-smokers what is the ratio of smokers to non-smokers?

54. If 40% of the applicants to a program were rejected, what is the ratio of number accepted to number rejected?

55. The measures of three angles in a triangle are in the ratio of 1:1:2. Which of the following must be true?

- I. The triangle is isosceles.
- II. The triangle is a right triangle.
- III. The triangle is equilateral.

56. What is the ratio of the circumference of a circle to its radius?

57. If  $a:b = 3:5$  and  $a:c = 5:7$ , what is the value of  $b:c$ ?

58. If  $x$  is a positive number and  $\frac{x}{3} = \frac{12}{x}$ , then  $x =$

59. A snail can move  $i$  inches in  $m$  minutes. At this rate, how many feet can it move in  $h$  hours?

60. Barbara can grade  $t$  tests in  $\frac{1}{x}$  hours. At this rate, how many tests can she grade in  $x$  hours?

61. If 500 pounds of mush will feed 20 pigs for a week, for how many days will 200 pounds of mush

feed 14 pigs?

62. John can read 72 pages per hour. At this rate, how many pages can he read in 72 mins?

63. If  $3a = 2b$  and  $3b = 5c$ , what is the ratio of  $a$  to  $c$ ?

✓ 64. If  $\frac{3x-1}{25} = \frac{x+5}{11}$ , what is the value of  $x$ ?

✓ 65. Three associates agreed to split the profit in the ratio 2:5:8. If the profit was \$3,000, what is the difference between the largest share and the smallest?

66. If  $y$  varies inversely as  $x$ , and  $y = 8$  when  $x = 4$ , what is the value of  $y$  when  $x = 5$ ?

67. Judy's average (arithmetic mean) on four tests is 80. Assuming she can earn no more than 100 on any test, what is the least she can earn on her fifth test and still have a chance for an 85 average after seven tests?

✓ 68. If  $a+b = 3(c+d)$ , which of the following is the average of  $a, b, c$  and  $d$ ?

(a)  $\frac{c+d}{4}$

(b)  $\frac{3(c+d)}{8}$

this

72 mins?

(c)  $\frac{c+d}{2}$

(d)  $\frac{3(c+d)}{4}$

ratio of

(e)  $c+d$

if  $x$ ?69. What is the average of  $2^{10}$  and  $2^{20}$ ?

(a)  $2^{15}$

(b)  $2^5 + 2^{10}$

(c)  $2^9 + 2^{19}$

(d)  $2^{29}$

(e) 30.

profit in  
\$3,000,  
profit70. Let  $M$  be the median, and  $m$  the mode, of the following set of nos.: 10, 70, 20, 40, 70, 90. What is the average of  $M$  and  $m$ ?8 when  
 $x=5$ ?

in four

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and still  
age after

71. The average weight of the students in the French Club is 150 pounds, and the average weight of the students in the Spanish Club is 130 pounds. If no one is a member of both clubs, if the average weight of all the students is 142 pounds, and if there are 30 members in the French club, how many members are there in the Spanish club?

allowing is



## Algebra:

1. If  $a^2 - b^2 = 21$  and  $a^2 + b^2 = 29$ , what could be the possible values of  $ab$ ?
2. What is the average of  $x^2 + 2x - 3$ ,  $3x^2 - 2x - 3$  and  $30 - 4x^2$ ?
3. If  $a^2 + b^2 = 4$  and  $(a - b)^2 = 2$ , what is the value of  $ab$ ?
4. If  $\frac{1}{a} + \frac{1}{b} = \frac{1}{c}$  and  $ab = c$ , what is the average of 'a' and 'b'?
5.  $\frac{x^3 + 3x^2 - 10x}{2x^2 - 8}$  is equivalent to
6. What is the value of  $\frac{a^2 - b^2}{a - b}$  when  $a = 17.9$  and  $b = 19.7$ ?
7. If  $x^2 - y^2 = 28$  and  $x - y = 8$ , what is the average of  $x$  and  $y$ ?
8. If  $\left(\frac{1}{a} + a\right)^2 = 100$ , what is the value of  $\frac{1}{a^2} + a^2$ ?
9. If  $4x + 13 = 7 - 2x$ , what is the value of  $x$ ?

10. If  $ax - b = c - dx$ , what is the value of  $x$  in terms of  $a, b, c$  &  $d$ ?
11.  $\frac{1}{3}x + \frac{1}{6}x + \frac{1}{9}x = 33$ , what is the value of  $x$ ?
12. If  $7 - 2\sqrt{x} = 14$ , what is the value of  $x$ ?
13. If  $32^{a+b} = 16^{a+2b}$ , then 'a' in terms of  $b$ ?
14. If the average of  $3a$  and  $4b$  is less than 50, and 'a' is twice  $b$ , what is the largest integer value of  $a$ ?
15. If  $\frac{1}{a-b} = 5$ , then  $a =$  ?
16. If  $x = 3a + 7$  and  $y = 9a^2$ , what is  $y$  in terms of  $x$ ?
17. A solution of  $3|x+1| - 5 = 2$  is ?
18. If  $7x + 10 = 44$ , what is the value of  $7x - 10$ ?
19. If  $x^{-3} = \frac{1}{4x}$ , what is the value of  $x$ ?
20. If  $x^2 + 3 < 4$  and  $2x^2 + 3 > 4$ , what is one possible value of  $x$ ?

21. In the afternoon, Judy read 100 pages @ 60 pages per hour; in the evening, she read another 100 pages @ 40 pages per hour. In pages per hour, what was her average rate of reading for the day?
22. If the sum of five consecutive integers is  $S$ , what is the largest of those integers in terms of  $S$ ?
23. A jar contains only red, white and blue marbles. The number of red marbles is  $\frac{4}{5}$  the number of white ones, and the number of white ones is  $\frac{3}{4}$  the number of blue ones. If there are 470 4 marbles in all, how many of them are blue?
24. A stall was selling two types of candy: lollipops at 40 cents each and chocolate bars at 75 cents each. On Monday, the members sold 150 candies and raised 74 dollars. How many lollipops did they sell?
25. On a certain project the only grades awarded were 75 and 100. If 85 students completed the project and the average of their grades was 85, how many earned 100?

26. Aaron has 3 times as much money as Josh.

If Aaron gives Josh \$50, Josh will then have 3 times as much money as Aaron.

How much money do the two of them have together?

27. If  $\frac{1}{2}x$  years ago Jason was 12, and  $\frac{1}{2}x$  years from now he will be  $2x$  years old, how old will he be  $3x$  years from now?

28. Two printing presses working together can complete a job in 2.5 hours. Working alone, press 'A' can do the job in 10 hours. How many hours will press 'B' take to do the job by itself?

29. What is the greater of two numbers whose product is 900, if the sum of the two numbers exceed their difference by 30?

30. The number of shells in Fred's collection is 80% of the number in Phil's collection. If Phil has 80 more shells than Fred, how many do they have altogether?



31. Karen played a game several times. she received \$5 every time she won and had to pay \$2 every time she lost. If the ratio of the number of times she won to the number of times she lost was 3:2 and if she won a total of \$66, how many times did she play this game?

32. Each of the 10 players on the basketball team shot 100 free throws, and the average number of baskets made was 75. When the highest and lowest scores were eliminated, the average number of baskets for the remaining 8 players was 79. What is the smallest number of baskets anyone could have made?

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