

1 Arithmetic Problems

1 Problem Calculate: $1 - 2 + 3 - 4 + 5 - 6 + 7 - 8 + 9 - 10$.

2 Problem Calculate: $(2 \cdot (-3) + 1)^2 - ((-5) \cdot 4 + 2 \cdot 9)^3$.

3 Problem Calculate: $\frac{\frac{3}{5} \div \frac{5}{3}}{\frac{3}{5} + \frac{5}{3}}$.

4 Problem Calculate: $\left(\frac{2}{5}\right)^2 + 2 \cdot \left(\frac{2}{5}\right)\left(\frac{3}{10}\right) + \left(\frac{3}{10}\right)^2$.

5 Problem Calculate: $(2 + 3 + 4)(2^2 + 3^2 + 4^2 - 2 \cdot 3 - 3 \cdot 4 - 4 \cdot 2)$.

6 Problem Calculate: $10(0.1)(-0.02) + 20(0.1)^2$.

7 Problem Calculate: $\frac{100^3 + 100^3 + 100^3 + 100^3 + 100^3 + 100^3}{100^2 + 100^2 + 100^2}$.

8 Problem Calculate: $123456^2 - 123455^2$.

9 Problem In this problem, you are allowed to use any of the operations $+$, $-$, \div , \cdot , the decimal point, and exponentiation. You must use exactly four 4's. Among your fours you may also use $.4$. Write the numbers 60, 64, 68, 100 and 160 with these restrictions.

10 Problem Calculate: $\frac{1}{2 + \frac{3}{4 + \frac{1}{5}}}$.

11 Problem Calculate: $(123^2 \cdot 456^2 - 789)^0 + 3 \cdot 2^3$.

12 Problem What is the value of $((1 \times 2 \div (3 \times 4) - 5) \times 6 - 7) \div (8 \times 9)$?

13 Problem Write as a single fraction. If the result is an "improper fraction," leave it in that form.

$$\frac{1}{3} + \frac{2}{5} - \frac{3}{7}$$

14 Problem Write as a single fraction. If the result is an "improper fraction," leave it in that form.

$$\frac{1}{3} \cdot \frac{2}{5} \div \frac{3}{7}$$

15 Problem Convert into a fraction and express in lowest terms: 0.204

16 Problem Convert into a decimal: $\frac{9}{11}$.

17 Problem Calculate: $\frac{(10)^3 + (-5)^3 + (1)^3 - 3(10)(-5)(1)}{(10) + (-5) + (1)}$.

18 Problem Calculate: $1020.4016 \div 637.751$.

2 Algebraic Notation Problems

19 Problem A group of p people charters a bus for a trip for D dollars. If they must pay an equal share, what is this share? If the night before the trip x people decide they can't attend the trip, what is the share of the people remaining?

20 Problem If you have a one-dollar bills, b five-dollar bills, c ten-dollar bills and d twenty-dollar bills, what amount of dollars do you have?

21 Problem If you have a one-dollar bills, b five-dollar bills, c ten-dollar bills and d twenty-dollar bills, how many bills do you have?

22 Problem If x is the unknown quantity, translate "the square of a quantity reduced by its triple" into symbols.

23 Problem You start the day with A dollars. Your uncle Bob gives you enough money to double your amount. Your aunt Rita gives you 10 dollars. You have to pay B dollars in fines, and spent 12 dollars fueling your camel with gas. How much money do you have now?

24 Problem If a and b are the unknown quantities, translate "the square of the sum two quantities" into symbols.

25 Problem If a and b are the unknown quantities, translate "the sum of the squares of two quantities" into symbols.

26 Problem If $n = 1, 2, 3, \dots$ indicates the position of the general term of the arithmetic progression $1, 7, 13, 19, \dots$, give a formula for its general term.

27 Problem You begin the day with E eggs. During the course of the day, you fry O omelettes, each requiring A eggs. How many eggs are left?

28 Problem Think of a number. Double it. Add 10. Half your result. Subtract your original number. After these five steps, your answer is 5 regardless of your original number! If x is the original number, explain by means of algebraic formulæ each step.

3 Evaluation Problems

29 Problem Evaluate the expression $(a + b)^2 + (a - b)^2$ when $a = 3$ and $b = -2$.

30 Problem Evaluate the expression $\frac{a}{b} + \frac{b}{a} - \frac{a+b}{a-b}$ when $a = 3$ and $b = -2$.

31 Problem Evaluate the expression $a^{-b} + b^a$ when $a = 3$ and $b = -2$.

32 Problem Evaluate the expression $xy^2 + x^2y - 2xy$ when $x = -\frac{1}{2}$ and $y = \frac{2}{3}$.

33 Problem Evaluate the expression $(x^2 + 2xy + y^2)^0$ when $x = 12345$ and $y = 54321$.

34 Problem Evaluate the expression $\frac{x^2 + 1}{1 - x^2}$ when $x = -1$.

35 Problem Evaluate the expression $x + 2x^2 + 3x^3$ when $x = -0.1$.

36 Problem Evaluate $a - 2b + 3c - 4d$ when $a = x$, $b = 2x$, $c = 3x$, and $d = 4x$.

37 Problem Evaluate $\frac{u}{v} + \frac{v}{u} + 2$ when $u = -\frac{x}{2}$ and $v = \frac{3x}{2}$.

38 Problem Evaluate $U^2 + (U + V)^2 - (U - V)^2 + V^2$ when $U = 2x$ and $V = -3x$.

4 Algebraic Operations Problems

39 Problem Collect like terms: $2(a + 2b + 3c) - 2(a - 3b + c)$.

40 Problem Collect like terms: $\frac{a}{7} + \frac{a}{5}$.

41 Problem Expand and collect like terms: $(x - 1)^2$.

42 Problem Expand and collect like terms: $x(x - 1) - (x - 1)^2$.

43 Problem Expand and collect like terms: $(x + 2)(x^2 - 2x + 4) - (x - 2)(x^2 + 2x + 4)$.

44 Problem Expand and collect like terms: $3(2x - 4) - \frac{24x - 12}{4}$.

45 Problem Perform the division: $\frac{6x^3 - 12x^2}{-2x^2}$.

46 Problem Perform the division: $\frac{(6x^3)(-12x^2)}{-2x^2}$.

47 Problem If $\frac{(x^3)^3 x^7}{(x^3)(x^2)^2} = x^n$, find n .

48 Problem If $25^3 = 5^n$, find n .

5 Factoring Problems

49 Problem Factor -1 from $1 - 2x$.

50 Problem Factor 2 from $1 - 2x$.

51 Problem Factor $x^3 y^2$ from $x^3 y^3 + x^4 y^2 - x^3 y^2$.

52 Problem Factor $\frac{4x}{3y}$ from $\frac{12x^3}{y^5} + \frac{3y}{x}$.

53 Problem Factor $\frac{x^2}{4} - \frac{4}{x^2}$.

54 Problem Factor $a^2 b^2 - x^2 y^2$.

55 Problem Factor $a^3 b^3 - x^3 y^3$.

56 Problem Factor $\frac{x^3}{8} - \frac{8}{x^3}$.

57 Problem Factor $x^3 - x$ as the product of three non-constant polynomials.

58 Problem Factor $x^4 - 1$ as the product of three non-constant polynomials.

6 Equation Problems

59 Problem Determine which of the following equations are tautologies, conditional, or contradictions:

$$I: 4x + 2 = 2(2x + 1) \quad II: 4x + 2 = -2(2x + 1) \quad III: 4x + 2 = 2(2x + 1) + 1 \quad IV: 3x = 2x.$$

60 Problem Solve for x : $4x - 3 = 9$.

61 Problem Solve for x : $\frac{3-x}{2} = \frac{1-2x}{3}$.

62 Problem Solve for x : $\frac{3-x}{2} - 1 = \frac{1-2x}{3}$.

63 Problem Solve for x : $\frac{ax-b}{a} = \frac{b-cx}{c}$.

64 Problem The formula

$$F - 32 = \frac{9}{5}C$$

expresses the relationship between degrees Fahrenheit and Celsius. Solve for C . How many degrees Celsius are 77° F?

65 Problem Solve for x : $4x - b = a$.

66 Problem Solve for x : $\frac{bx}{a} + \frac{ax}{b} = 1$.

67 Problem Solve for x : $\frac{x}{3} + \frac{1}{2} = \frac{1}{6}$.

68 Problem Solve for x : $\frac{x-2}{3} = 5$.

69 Problem Solve for x : $2(3x - 4) - 4(2 - 3x) = 1$.

70 Problem Solve for x : $x - \frac{x}{2} - \frac{x}{3} = 1$.

71 Problem Solve for x : $\frac{x-2}{2} = \frac{3-x}{3}$.

72 Problem Solve for x : $\frac{x}{a} - 1 = 2$.

73 Problem Solve for x : $\frac{ax}{b} = a$.

74 Problem Solve for x : $ax + b = c$.

75 Problem Solve for x : $\frac{x+a}{2} = 2x + 1$.

76 Problem Solve for x : $\frac{x+1}{2} - \frac{x+2}{3} = \frac{x-1}{4}$.

77 Problem Solve for x : $\frac{a}{x} = b$.

78 Problem Solve for x : $\frac{ab}{cx} = d$.

79 Problem Solve for x : $\frac{3}{x-2} = 1$.

80 Problem Solve for x : $\frac{3}{x-2} = \frac{2}{x+3}$.

7 Problems on Inequalities

81 Problem Make a sublist of the numbers x on the list $\left\{10, 0, -5, -100, -4.001, -3.999, 4, -\frac{401}{100}, -\frac{401}{100}\right\}$ that satisfy the inequality $x < -4$.

82 Problem Solve the inequality and graph its solution set: $4x + 1 \leq 5x$.

83 Problem Solve the inequality and graph its solution set: $5x + 1 \leq 4x$.

8 Word Problems

84 Problem Rahnnya takes 20 minutes to solve 3 maths problems. At this rate, how many minutes will it take her to solve 2880 problems?

85 Problem On a certain map City A is 4 inches apart from City B. If the scale is such that 1.2 inches represent 30 miles, find the actual distance, in miles, between City A and City B.

86 Problem Nanette is going to make *crêpes*. Her recipe requires 3 fl oz of beer for every 2 eggs. If she is going to utilise 8 eggs, how many fluid ounces of beer does she need?

87 Problem Find 30% of 810.

88 Problem 840 is 28% of what number?

89 Problem What percent of 408 is 34?

90 Problem Hillary trades goats for a 40% profit. If the original price of a goat is \$90, find the new selling price.

91 Problem You bought some furniture for \$424.53, price which included a 6% sales tax. What was the price of piece, before sales tax?

92 Problem After a night of beer and pizza, the bill comes to a total of \$34.20, including sales tax. If you are leaving a 15% tip, how much will you end up paying?

93 Problem A number is trebled and then the result is increased by 20, obtaining 107 as the final answer. What was the original number?

94 Problem An amount of \$493 is split between Peter, Paul and Mary so that Mary has six times as Peter, and Mary has four times as Paul. How much money does Peter have?

95 Problem A piece of equipment is bought by a factory. During its first year, the equipment depreciates a fifth of its original price. During its second year, it depreciates a sixth of its new value. If its current value is \$56, 000, what was its original price?

96 Problem The sum of five consecutive integers is 665. Which one is the middle number?

9 True or False Questions

97 Problem True or false: $(2 + 3)^{10} = 2^{10} + 3^{10}$.

98 Problem True or false: $2x + 3x = 5x^2$ for all values of x .

99 Problem True or false: $-3^2 = 9$.

100 Problem True or false: $(-3)^2 = 9$.

101 Problem True or false: $A\%$ of B is the same as $B\%$ of A .

10 Equivalent Expression Problems

102 Problem Circle all which are equivalent to $\frac{a-b}{b-a}$.

- (A) -1 (B) $\frac{b-a}{a-b}$ (C) 1 (D) $\frac{u-v}{v-u}$ (E) $2^3 - 3^2$

103 Problem Circle all which are equivalent to $10x\left(\frac{y}{5} + x\right)$.

- (A) $\frac{xy}{2} + 10x^2$ (B) $2xy + 10x$ (C) $10\left(\frac{y}{5} + x\right)x$ (D) $5x \cdot \left(x + \frac{y}{5}\right) \cdot 2$ (E) $2xy + 10x^2$

104 Problem Circle all which are equivalent to $(2a + b)^2$.

- (A) $(b + 2a)^2$ (B) $4a^2 + b^2$ (C) $4a^2 + 4ab + b^2$ (D) $b^2 + 2(2ab) + (2a)^2$ (E) $(-2a - b)^2$

105 Problem Circle all which are equivalent to $(2x^2y^2)(3xy^4) =$

- (A) $6x^3y^6$ (B) $6(xy^4)^2$ (C) $6(xy^2)^3$ (D) $\frac{12x^9y^{12}}{2x^3y^2}$ (E) $\frac{12x^6y^7}{2x^3y}$

11 Answers

1 $1 - 2 + 3 - 4 + 5 - 6 + 7 - 8 + 9 - 10 = -1 - 1 - 1 - 1 - 1 = -5$.

2 $(2 \cdot (-3) + 1)^2 - ((-5) \cdot 4 + 2 \cdot 9)^3 = (-6 + 1)^2 - (-20 + 18)^3 = (-5)^2 - (-2)^3 = 25 - (-8) = 33$.

3 $\frac{\frac{3}{5} \div \frac{5}{3}}{\frac{5}{5} + \frac{3}{3}} = \frac{\frac{3}{5} \cdot \frac{3}{5}}{\frac{9}{15} + \frac{25}{15}} = \frac{\frac{9}{25}}{\frac{34}{15}} = \frac{9}{25} \cdot \frac{15}{34} = \frac{27}{170}$

4 $\left(\frac{2}{5}\right)^2 + 2 \cdot \left(\frac{2}{5}\right) \cdot \left(\frac{3}{10}\right) + \left(\frac{3}{10}\right)^2 = \frac{4}{25} + \frac{12}{50} + \frac{9}{100} = \frac{16}{100} + \frac{24}{100} + \frac{9}{100} = \frac{49}{100}$

5 $(2 + 3 + 4)(2^2 + 3^2 + 4^2) - 2 \cdot 3 \cdot 3 \cdot 4 \cdot 4 \cdot 2 = (9)(4 + 9 + 16 - 6 - 12 - 8) = (9)(3) = 27$

6 $10(0.1)(-0.02) + 20(0.1)^2 = (1)(-0.02) + 20(0.1)(0.1) = -0.02 + 2(0.1) = -0.02 + 0.2 = 0.18$

7 $\frac{100^3 + 100^3 + 100^3 + 100^3 + 100^3 + 100^3}{100^2 + 100^2 + 100^2} = \frac{6 \cdot 100^3}{3 \cdot 100^2} = 2 \cdot 100 = 200$.

8 $123456^2 - 123455^2 = (123456 - 123455)(123456 + 123455) = 1(246911) = 246911$.

$$9 \quad 60 = 4 \cdot 4 \cdot 4 - 4, 64 = (4+4)(4+4), 68 = 4 \cdot 4 \cdot 4 + 4, 100 = \left(\frac{4}{.4}\right)\left(\frac{4}{.4}\right), 160 = \left(\frac{4}{.4}\right)(4)(4).$$

$$10 \quad \frac{1}{2 + \frac{3}{\frac{1}{4 + \frac{5}{5}}}} = \frac{1}{2 + \frac{3}{\frac{5}{21}}} = \frac{1}{2 + 3 \cdot \frac{5}{21}} = \frac{1}{2 + \frac{5}{7}} = \frac{1}{\frac{19}{7}} = \frac{7}{19}.$$

$$11 \quad (123^2 \cdot 456^2 - 789)^0 + 3 \cdot 2^3 = 1 + 3 \cdot 2^3 = 1 + 3 \cdot 8 = 1 + 24 = 25.$$

$$12 \quad -\frac{1}{2}.$$

$$13 \quad \frac{32}{105}$$

$$14 \quad \frac{14}{45}$$

$$15 \quad \frac{51}{250}$$

$$16 \quad 0.\overline{81}$$

$$17 \quad 171$$

$$18 \quad 1.6$$

$$19 \quad \frac{D}{p}; \frac{D}{p-x}$$

$$20 \quad a + 5b + 10c + 20d$$

$$21 \quad a + b + c + d$$

$$22 \quad x^2 - 3x$$

23 You start with A , your uncle Bob gives you A more so that you now have $A + A = 2A$. Your Aunt Rita gives you 10 more, so that now you have $2A + 10$. You pay B dollars in fines, hence you are left with $2A + 10 - B$. You spent 12 in fuel, so now you have

$$2A + 10 - B - 12 = 2A - B - 2,$$

in total.

$$24 \quad (a + b)^2$$

$$25 \quad a^2 + b^2$$

$$26 \quad 1 + 6(n - 1)$$

27 $E - OA$, since OA eggs are used in frying O omelettes.

28 On the first step you have x . On the second step you have $2x$. On the third step you have $2x + 10$. On the fourth step you have $\frac{2x + 10}{2}$. On the fifth step you have $\frac{2x + 10}{2} - x$. You are asserting that $\frac{2x + 10}{2} - x$ is identically equal to 5.

$$29 \quad (a + b)^2 + (a - b)^2 = (3 + (-2))^2 + (3 - (-2))^2 = 1^2 + 5^2 = 26$$

$$30 \quad \frac{a}{b} + \frac{b}{a} - \frac{a+b}{a-b} = \frac{3}{-2} + \frac{-2}{3} - \frac{3+(-2)}{3-(-2)} = -\frac{71}{30}$$

$$31 \quad a^{-b} + b^a = 3^{-(-2)} + (-2)^3 = 3^2 + (-8) = 9 + (-8) = 1$$

$$32 \quad xy^2 + x^2y - 2xy = \left(-\frac{1}{2}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right) + \left(-\frac{1}{2}\right)\left(-\frac{1}{2}\right)\left(\frac{2}{3}\right) - 2\left(-\frac{1}{2}\right)\left(\frac{2}{3}\right) = -\frac{2}{9} + \frac{1}{6} + \frac{2}{3} = \frac{11}{18}$$

$$33 \quad (x^2 + 2xy + y^2)^0 = 1$$

$$34 \quad \frac{x^2 + 1}{1 - x^2} - \frac{1^2 + 1}{1 - 1^2} = \frac{2}{0}, \text{ this is undefined.}$$

$$35 \quad x + 2x^2 + 3x^3 = -0.1 + 2(-0.1)(-0.1) + 3(-0.1)(-0.1)(-0.1) = -0.083$$

$$36 \quad a - 2b + 3c - 4d = x - 2(2x) + 3(3x) - 4(4x) = x - 4x + 9x - 16x = -10x.$$

$$37 \quad \frac{u}{v} + \frac{v}{u} + 2 = \frac{-\frac{x}{2}}{\frac{3x}{2}} + \frac{\frac{3x}{2}}{-\frac{x}{2}} + 2 = -\frac{x}{2} \cdot \frac{2}{3x} - \frac{3x}{2} \cdot \frac{2}{-x} + 2 = -\frac{1}{3} - 3 + 2 = -\frac{4}{3}.$$

$$38 \quad U^2 + (U + V)^2 - (U - V)^2 + V^2 = (2x)^2 + (-x)^2 - (5x)^2 + (-3x)^2 = 4x^2 + x^2 - 25x^2 + 9x^2 = -11x^2.$$

$$39 \quad 2(a + 2b + 3c) - 2(a - 3b + c) = 2a + 4b + 6c - 2a + 6b - 2c = 10b + 4c$$

$$40 \quad \frac{a}{7} + \frac{a}{5} = \frac{5a}{35} + \frac{7a}{35} = \frac{12a}{35}.$$

$$41 \quad x^2 - 2x + 1$$

$$42 \quad x(x-1) - (x-1)^2 = x^2 - x - x^2 + 2x - 1 = x - 1$$

$$43 \quad (x+2)(x^2 - 2x + 4) - (x-2)(x^2 + 2x + 4) = (x^3 - 2x^2 + 4x + 2x^2 - 4x + 8) - (x^3 + 2x^2 + 4x - 2x^2 - 4x + 8) = 16.$$

$$44 \quad 3(2x-4) - \frac{24x-12}{4} = 6x - 12 - (6x-3) = 6x - 12 - 6x + 3 = -9.$$

$$45 \quad \frac{6x^3 - 12x^2}{-2x^2} = \frac{6x^3}{-2x^2} - \frac{12x^2}{-2x^2} = -3x + 6$$

$$46 \quad \frac{(6x^3)(-12x^2)}{-2x^2} = \frac{-72x^5}{-2x^2} = -36x^3$$

$$47 \quad \frac{(x^3)^3 x^7}{(x^3)(x^2)^2} = \frac{x^9 x^7}{x^3 x^4} = \frac{x^{16}}{x^7} = x^9, \text{ so } n = 9.$$

$$48 \quad n = 6$$

$$49 \quad 1 - 2x = -1(-1 + 2x).$$

$$50 \quad 1 - 2x = 2\left(\frac{1}{2} - x\right).$$

$$51 \quad x^3 y^3 + x^4 y^2 - 2x^3 y^2 = x^3 y^2 (y + x - 1).$$

$$52 \quad \frac{12x^3}{y^5} + \frac{3y}{x} = \frac{4x}{3y} \left(\frac{9x^2}{y^4} + \frac{9y^2}{4x^2} \right).$$

$$53 \quad \frac{x^2}{4} - \frac{4}{x^2} = \left(\frac{x}{2} - \frac{2}{x} \right) \left(\frac{x}{2} + \frac{2}{x} \right).$$

$$54 \quad a^2 b^2 - x^2 y^2 = (ab - xy)(ab + xy).$$

$$55 \quad a^3 b^3 - x^3 y^3 = (ab - xy)(a^2 b^2 + abxy + x^2 y^2).$$

$$56 \quad \frac{x^3}{8} - \frac{8}{x^3} = \left(\frac{x}{2} - \frac{2}{x} \right) \left(\frac{x^2}{4} + 1 + \frac{4}{x^2} \right).$$

$$57 \quad x^3 - x = x(x^2 - 1) = x(x-1)(x+1).$$

$$58 \quad x^4 - 1 = (x^2 - 1)(x^2 + 1) = (x-1)(x+1)(x^2 + 1).$$

59 I is a tautology. II and IV are conditional. III is a contradiction.

$$60 \quad 4x - 3 = 9 \Rightarrow 4x = 9 + 3 \Rightarrow 4x = 12 \Rightarrow x = 3$$

61 Cross-multiplying and using the distributive law,

$$\frac{3-x}{2} = \frac{1-2x}{3} \Rightarrow 3(3-x) = 2(1-2x) \Rightarrow 9-3x = 2-4x.$$

Transposing,

$$9-3x = 2-4x \Rightarrow -3x+4x = 2-9 \Rightarrow x = -7.$$

62 The least common denominator of all fractions is 6, hence, multiplying through by 6:

$$6\left(\frac{3-x}{2} - 1\right) = 6\left(\frac{1-2x}{3}\right) \Rightarrow 3(3-x) - 6 = 2(1-2x).$$

Distributing and transposing,

$$3(3-x) - 6 = 2(1-2x) \Rightarrow 9-3x-6 = 2-4x \Rightarrow -3x+4x = 2-9+6 \Rightarrow x = -1.$$

63 Cross-multiplying and using the distributive law,

$$\frac{ax-b}{a} = \frac{b-cx}{c} \Rightarrow c(ax-b) = a(b-cx) \Rightarrow cax - cb = ab - acx.$$

Transposing,

$$cax + acx = ab + cb \Rightarrow 2acx = ab + cb \Rightarrow x = \frac{ab+cb}{ac}.$$

64 We have

$$F - 32 = \frac{9}{5}C \Rightarrow \frac{5}{9} \cdot (F - 32) = \frac{5}{9} \cdot \frac{9}{5}C \Rightarrow C = \frac{5}{9} \cdot (F - 32).$$

Thus, when $F = 77$,

$$C = \frac{5}{9} \cdot (77 - 32) = \frac{5}{9} \cdot 45 = 25,$$

hence 77° Fare 25° C.

65 $4x - b = a \Rightarrow 4x = a + b \Rightarrow x = \frac{a + b}{4}$

66 $\frac{bx}{a} + \frac{ax}{b} = 1 \Rightarrow \frac{b^2x}{ab} + \frac{a^2x}{ab} = 1 \Rightarrow \frac{b^2x + a^2x}{ab} = 1 \Rightarrow b^2x + a^2x = ab \Rightarrow x(b^2 + a^2) = ab \Rightarrow x = \frac{ab}{a^2 + b^2}$

67 $\frac{x}{3} + \frac{1}{2} = \frac{1}{6} \Rightarrow \frac{x}{3} = -\frac{1}{2} + \frac{1}{6} \Rightarrow \frac{x}{3} = -\frac{3}{6} + \frac{1}{6} \Rightarrow \frac{x}{3} = -\frac{2}{6} \Rightarrow x = -\frac{3}{6} = -\frac{1}{2}.$

68 $\frac{x-2}{3} = 5 \Rightarrow x-2 = 3(5) \Rightarrow x-2 = 15 \Rightarrow x = 15+2 \Rightarrow x = 17.$

69 $x = \frac{17}{18}$

70 $x = 6$

71 $x = \frac{12}{5}$

72 $x = 3a$

73 $x = b$

74 $x = \frac{c-b}{a}$

75 $x = \frac{a-2}{3}$

76 $x = 1$

77 $x = \frac{a}{b}$

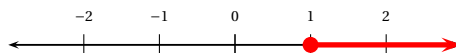
78 $x = \frac{cd}{ab}$

79 $x = 5$

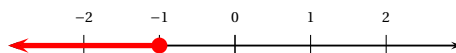
80 $x = -13$

81 $\left\{-5, -100, -4.001, -\frac{401}{100}\right\}$

82 $4x + 1 \leq 5x \Rightarrow 4x - 5x \leq -1 \Rightarrow -x \leq -1 \Rightarrow x \geq 1.$



83 $5x + 1 \leq 4x \Rightarrow 5x - 4x \leq -1 \Rightarrow x \leq -1.$

84 Let x be the number of minutes she will take to solve 2880 problems. Then

$$\frac{20}{3} = \frac{x}{2880} \Rightarrow x = 19200.$$

She will take 19200 minutes.

85 Let x be the actual distance in miles. Then

$$\frac{30}{4} = \frac{x}{1.2} \Rightarrow x = 1.2 \cdot \frac{30}{4} = 1.2 \cdot \frac{15}{2} = 0.6 \cdot 15 = 9.$$

City A is 9 miles apart from City B.

86 Let x be the number of fluid ounces of beer needed. Then

$$\frac{3}{2} = \frac{x}{8} \Rightarrow x = 8 \cdot \frac{3}{2} = 12.$$

She will need 12 fluid ounces of beer.

87 Let x be 30% of 810. Then

$$x = \frac{30}{100} \cdot 810 = 243.$$

88 Let the number be x . Then

$$840 = x \cdot \frac{28}{100} \Rightarrow x = 840 \cdot \frac{100}{28} = 3000.$$

89 Let x be the percent. Then

$$\frac{x}{100} \cdot 408 = 34 \Rightarrow \frac{408x}{100} = 34 \Rightarrow x = 34 \cdot \frac{100}{408} = \frac{25}{3}.$$

Thus 34 is $\frac{25}{3}$ % of 408.

90 Let x be the new selling price. Then $x = 1.4 \cdot 90 = 126$. The new selling price is \$126.

91 Let x be the original price. Then

$$1.06x = 424.53 \Rightarrow x = \frac{424.53}{1.06} = 400.50.$$

The piece costs \$400.50 before sales tax.

92 Let x be the amount you will end up paying. Then

$$x = (1.15)(34.20) = 39.33.$$

You will end up paying \$39.33.

93 Let x be number. Then $3x + 20 = 107 \Rightarrow 3x = 107 - 20 \Rightarrow 3x = 87 \Rightarrow x = \frac{87}{3} = 29$. The original number was 29.

94 Let x be Peter's amount. Then Mary's amount is $6x$ and Paul's $\frac{6x}{4} = \frac{3x}{2}$. We have

$$x + 6x + \frac{3x}{2} = 493 \Rightarrow 7x + \frac{3x}{2} = 493 \Rightarrow \frac{14x}{2} + \frac{3x}{2} = 493 \Rightarrow \frac{17x}{2} = 493 \Rightarrow x = 493 \cdot \frac{2}{17} = (29)(2) = 58.$$

Peter has \$58, Mary has \$348, and Paul has \$87.

95 Let the original price be P . After a year, the equipment costs $\frac{4P}{5}$. After the second year it costs $\frac{5}{6} \left(\frac{4P}{5} \right)$. Hence

$$\frac{5}{6} \left(\frac{4P}{5} \right) = 56000 \Rightarrow \frac{4P}{6} = 56000 \Rightarrow P = \frac{6}{4} \cdot 56000 \Rightarrow P = 84000.$$

96 Let $x, x+1, x+2, x+3, x+4$ be the integers. Then

$$x + x + 1 + x + 2 + x + 3 + x + 4 = 665 \Rightarrow 5x + 10 = 665 \Rightarrow 5x = 655 \Rightarrow 131.$$

The middle number is thus $131 + 2 = 133$.

97 False.

98 False.

99 False.

100 True.

101 True.

102 A, B, D, E.

103 C, D, E.

104 A, C, D, E.

105 A, C, E