

ALGEBRA I



QUESTION CATALOGUE

Algebra I

Question Catalogue Index

I. Logic

A. Logical Operations

1. Logical Equivalence	
a. Original and Contrapositive	1
b. Converse and Inverse	5
2. Translating Logic Statements	
a. Translating from Sentences to Symbols	9
b. Performing Logic Operations	14

B. Logic Proofs (Extended task)

1. Using Truth Tables	
a. Truth Tables & Tautologies	19
b. Truth Values of Sentences	30
2. Using Statements and Reasons	
a. Without Translation	35
b. With Translation	36

C. Applied Logic Questions

1. Real World Applications	
a. Using a Venn Diagram Question to Solve	37

II. Algebra

A. Numbers, Sets, Systems, and Operations

1. Basic Algebra	
a. Translating Algebraic Sentences	39
b. Order of Operations	41
c. Comparing Mathematical Expressions	44
d. The Set of Real Numbers	46
e. Multiplicative & Additive Inverse	48
f. Undefined Fractions	49
2. Mathematical Systems	
a. Properties of Operations	52

B. Simplifying Algebraic Expressions

1. Operations with Monomials	
a. Add & Sub of Monomials	55
b. Mult & Div of Monomials	56
2. Pos, Neg and Fractional Exponents	
a. Converting to Positive Exponents	59
3. Scientific Notation	
a. Express Large #'s	60
b. Express Small #'s	61
4. Operations with Polynomials	
a. Add & Sub of Polynomials	62
b. Mult of a Polynom by Monomial	64
c. Multiplication of Binomials (FOIL)	65
d. Div of Polynomials by a Monomial	67
5. Factoring Algebraic Expressions	
a. Factoring Using Distributive Property	69
b. Factoring Diff. of Two Perfect Squares	70
c. Factoring Trinomials ax^2+bx+c	71
d. Find the LCD or GCF	73
6. Simplifying Algebraic Expressions	
a. Add and Sub Algebraic Fractions	74
b. Simplifying Algebraic Fractions	77

7. Operations with Irrational Numbers	
a. Simplifying a Square Root Radical	78
b. Adding and Subtracting Radicals	79
c. Multiplying and Dividing Radicals	80

C. Solving Algebraic Equations in Using One Variable

1. First Degree Equations	
a. First Degree Equations with Integers	81
b. First Degree Equat with Rational #'s	82
2. Multiple Step Equations	
a. Two Step Equations	83
b. Equations with Parentheses	86
c. Equations with Variables in Both Sides	87
d. Equations with Fractions	89
3. Literal Equations	
a. Solving for a Variable in a Equation	91
b. Transforming Formulas	95
4. Word Problems	
a. Solving Ratio & Percent Problems	96
b. Solving Cons Integers Problems	98
c. Geometry Word Problems	101
d. Word Problems with Quadratics	103
5. Solving Quadratic Equations	
a. Solving Quadratic Equat by Factoring	106
b. Quadratic Formula with Equations	109
6. Mixed Type of Equations	
a. Disjunctions (or) Equations	110

D. Algebraic Inequalities in One Variable

1. First Degree Inequalities	
a. First Degree Inequalities with Integers	111
2. Multiple Step Inequalities	
a. Two Step Inequalities	112
b. Inequalities with Variables in Both Sides	113
3. Literal Inequalities	
a. Transforming Formulas	114
4. Word Problems for Inequalities Excl. Geometry	
a. Consecutive Integers Word Problems	114
5. Graphing Inequalities in One Variable	
a. Determining Graph from Statement	115
b. Determining Statement from Graph	118

E. Intermediate and Advanced Algebra

1. Using Both Simplification & Equations	
a. Extended Task Problems	120

III. The Coordinate Plane

A. Graphing Equations

1. Linear Equations and Slopes	
a. Finding the Slope and Y-Intercept	121
b. Finding Solutions in Open Sentences	127
c. Parallel Lines	130
2. Graphing a Linear Equation	
a. Graphing Equat Parallel to the X & Y Axis	131
b. Graphing Linear Equations	134
3. Sets of Equations Solved Graphically (Ext task)	
a. Solving a Pair of Linear Equat & Check	140
b. Graph Linear Equations & Use to Find Area	142
4. Sets of Equations Solved Algebraically	
a. Sets of Equations Solved Algebraically (Short Ans)	145
b. Sets of Equations Solved Algebraically (Ext Task)	148
c. Word Problem in Two Var (Ext Task)	151

5. Linear Inequalities	
a. Sets of Unequal Solved Graph (Ext Task)	154
b. Sets of Linear Inequalities (Short Ans)	158

IV. Ratios and Proportions

A. Mathematical Ratios

1. Using Ratios	
a. Word Problems Involving Ratios	163
b. Related Rates and Measure Conversion	165
c. The Measure of \angle 's in Polygons	167
2. Using Proportions	
a. Direct Variation	168
b. Verbal Problems Using Proportions	170
3. Percent and Percentage Problems	
a. Word Problems Using Percent	172

B. Similar Polygons and Right Triangles

1. Similar Polygons	
a. Lengths of Sides of Sim Polygons	175

V. Counting, Probability, and Statistics

A. Probability

1. Evaluating Simple Probabilities	
a. The Probability of "AND"	189
b. The Probability of "OR"	190
c. The Probability of "NOT"	192
2. Counting	
a. Counting & Sample Spaces	194
b. Permutations	199
c. Without Replacement	200
3. Probability	
b. Ext Task Probability Quest	201
4. Statistics	
a. Mean, Median and Mode	219
b. Quartiles & Percentiles	228
c. Histograms (Ext Task Prob)	230

I. Logic**B. Logic Proofs (Extended task)**

42. Below are three statements symbolized by p , q , and r .

Let p represent: 7 is an even number.

Let q represent: 9 is a prime number.

Let r represent: 25 is a perfect square.

a Write in words and tell whether the statement is true or false:

(1) $p \vee r$

(2) $r \rightarrow q$

(3) $\sim p \wedge \sim q$

b Write in symbolic form and give the truth value of the following statements

(1) 25 is a perfect square if and only if 7 is an even number.

(2) 9 is not a prime number or 7 is not an even number.

***a* (1) Seven is an even number of twenty-five is a perfect square.**

True

(2) If twenty-five is a perfect square then nine is a prime number.

False

(3) Seven is not an even number and nine is not a prime number.

True

***b* (1) $r \leftrightarrow p$**

False

(2) $\sim q \vee \sim p$

True

118. In the accompanying truth table, which statement should be the heading for column 3?

p	q	?
T	T	T
T	F	T
F	T	T
F	F	F

(1) $p \rightarrow q$

(3) $p \wedge q$

(2) $p \leftrightarrow q$

(4) $p \vee q$

1. Using Truth Tables**b. Truth Values of Sentences**

119. Each part below consists of three sentences. *On your answer paper*, write the letters *a* through *e* and next to each letter, write the truth value for the third sentence in each part based on the truth values given for the first two sentences.

<i>a</i>	John will buy a car. John will get a raise. John will buy a car if and only if John will get a raise.	TRUE FALSE ?
<i>b</i>	Physics is a science. Jan plays piano. Physics is a science and Jan does <i>not</i> play piano.	TRUE FALSE ?
<i>c</i>	If a polygon is a square, then the polygon is a rectangle. Polygon <i>ABCD</i> is a square. Polygon <i>ABCD</i> is a rectangle.	TRUE TRUE ?
<i>d</i>	I like apples or it is Tuesday. I like apples. It is Tuesday.	FALSE FALSE ?
<i>e</i>	If it is snowing, the roads are slippery. The roads are not slippery. It is not snowing.	TRUE TRUE ?

***a* False**

***b* True**

***c* True**

***d* False**

***e* True**

224. In the truth table below, which statement should be the heading for column 3?

Column 1	Column 2	Column 3
p	q	?
T	T	T
T	F	F
F	T	F
F	F	T

(1) $p \wedge q$

(3) $p \rightarrow q$

(2) $p \vee q$

(4) $p \leftrightarrow q$

II. Algebra**C. Solving Algebraic Equations in Using One Variable**

513. The length of a rectangle is 7 more than the side of a square. The width of the rectangle is equal to the side of the square. The area of the square is 56 less than the area of the rectangle. Find the width of the rectangle. [Only an algebraic solution will be accepted.]

Analysis**8**

545. In rectangle $ABCD$, AB is 7 inches longer than BC . The area of rectangle $ABCD$ is 60 square inches. Find the number of inches in AB . [Only an algebraic solution will be accepted.]

Analysis**12**

731. The length of a rectangle is $\sqrt{65}$ centimeters. The diagonal of the rectangle is 5 centimeters more than the width. Find, in centimeters, the width of the rectangle.

4

744. If the length of one side of a square is doubled and the length of an adjacent side is decreased by 3, the area of the resulting rectangle exceeds the area of the original square by 16. Find the length of a side of the original square. [Only an algebraic solution will be accepted.]

Analysis**8**

2149. The length of a rectangular solid is 7. The width of the solid is 2 more than the height. The volume of the solid is 105. Find the width and the height of the solid. [Only an algebraic solution will be accepted.]

Analysis**width = 5****height = 3**

2220. Which quadratic equation has -2 and 1 as its roots?

(1) $x^2 + x - 2 = 0$

(3) $x^2 - x + 2 = 0$

(2) $x^2 + x + 2 = 0$

(4) $x^2 - x - 2 = 0$

4. Word Problems**c. Geometry Word Problems**

2240. In right triangle ABC , $m\angle C = 3y - 10$, $m\angle B = y + 40$, and $m\angle A = 90$. What type of right triangle is triangle ABC ?

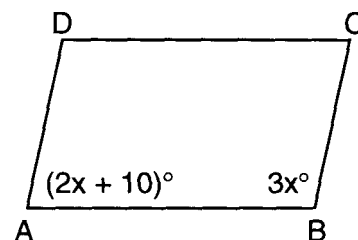
(1) scalene

(3) equilateral

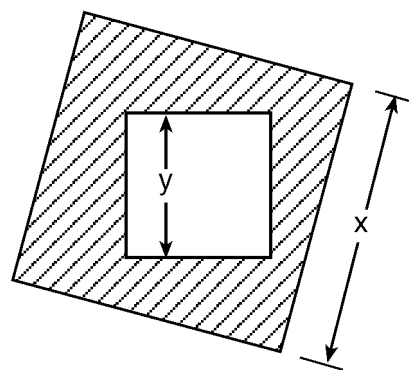
(2) isosceles

(4) obtuse

2278. In the accompanying diagram of parallelogram $ABCD$, $m\angle A = (2x + 10)$ and $m\angle B = 3x$. Find the number of degrees in $m\angle B$.

**102**

2551. The accompanying diagram shows a square with side y inside a square with side x .



Which expression represents the area of the shaded region?

(1) x^2

(3) $y^2 - x^2$

(2) y^2

(4) $x^2 - y^2$

III. The Coordinate Plane

A. Graphing Equations

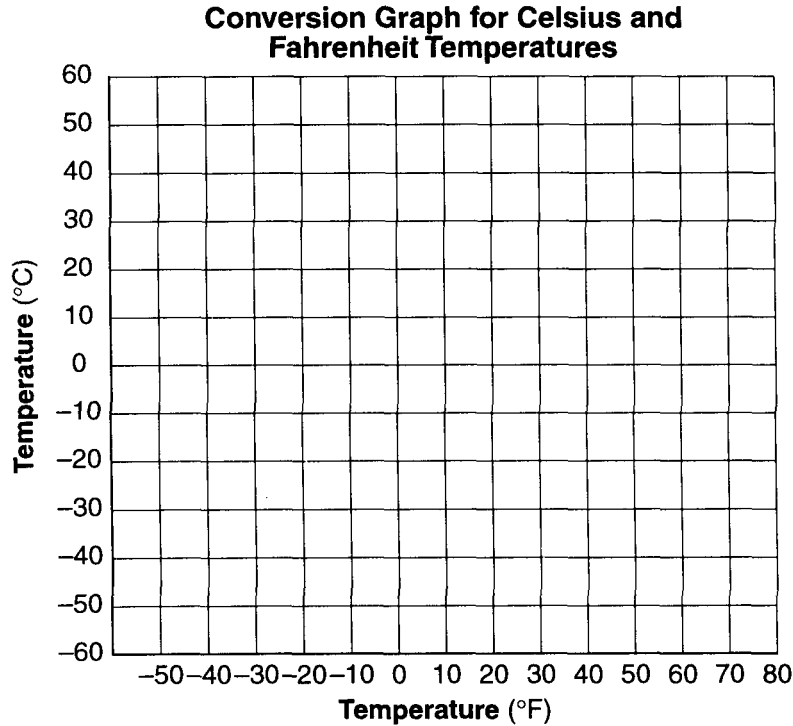
1149. What is the slope of the line whose equation is $y = 3x + 6$?
- (1) $\frac{1}{2}$ (2) 2 (3) **3** (4) 6
1153. What is the slope of the line whose equation is $4y = 3x + 16$?
- (1) $\frac{3}{4}$
1160. What is the slope of the graph of $y = 2x + 3$?
- (1) **2**
1167. The graph of which equation has a slope of 3 and a y -intercept of -2 ?
- (1) **$y = 3x - 2$** (2) $y = 3x + 2$ (3) $y = 2x - 3$ (4) $y = 2x + 3$
1178. What is the slope of the line whose equation is $y = 3x - 7$?
- (1) -7 (2) -3 (3) **3** (4) 7
1186. The y -intercept of the graph of $y = \frac{2}{3}x + \frac{8}{3}$ is
- (1) $\frac{3}{2}$ (2) 8 (3) $\frac{2}{3}$ (4) **$\frac{8}{3}$**
1191. The slope of the graph of $y = \frac{3}{4}x - 8$ is
- (1) 8 (2) -8 (3) **$\frac{3}{4}$** (4) $-\frac{4}{3}$
1193. What is the y -intercept of the line whose equation is $y = 2x - 5$?
- (1) 5 (2) 2 (3) -2 (4) **-5**
1201. What is the slope of the graph of the equation $y = 3$?
- (1) 1 (2) -3 (3) 3 (4) **0**
1209. The line whose equation is $y = \frac{1}{2}x + 3$ has a slope of
- (1) **$\frac{1}{2}$** (2) 2 (3) 3 (4) $\frac{1}{3}$

1. Linear Equations and Slopes

a. Finding the Slope and Y-Intercept

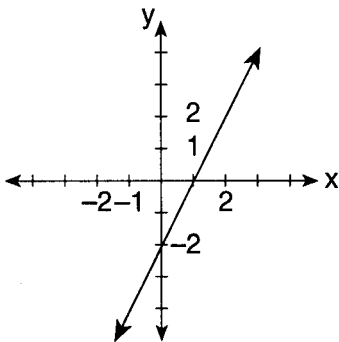
1214. The graph of which equation has a slope of 2?
- (1) **$y = 2x - 3$** (2) $y = -2x + 3$ (3) $y = 3x - 2$ (4) $y = -3x + 2$
1218. What is the y -intercept of the graph of the equation $y = 3x - 5$?
- (1) **-5**
1228. Find the slope of the line whose equation is $y = -2x - 4$.
- (1) **-2**
1231. The graph of the equation $y = 5$ intersects the y -axis at the point whose coordinates are
- (1) $(-5, 5)$ (2) **$(0, 5)$** (3) $(5, 0)$ (4) $(5, 5)$
1237. What is the slope of the graph of the equation $y = -x + 1$?
- (1) **-1**
1238. What are the coordinates of the y -intercept for the equation $y + 3x = 6$?
- (1) **$(0, 6)$** (2) $(0, -6)$ (3) $(0, 3)$ (4) $(0, -3)$
1241. A line has a slope of -2 and a y -intercept of 3. An equation of the line is
- (1) $y = 2x + 3$ (2) $y = 3x - 2$ (3) $y = 3x + 2$ (4) **$y = -2x + 3$**
1247. Which is an equation of a line whose slope is -2 ?
- (1) $y = 2x - 1$ (2) **$y = -2x + 1$** (3) $y = x - 2$ (4) $y - 2x = 4$
1253. An equation of the line with a slope of -2 and a y -intercept of 3 is
- (1) **$y = -2x + 3$** (2) $y = 3x - 2$ (3) $y = 2x + 3$ (4) $y = -2x - 3$
1263. The y -intercept of the graph of the equation $y = 2x - 3$ is
- (1) -2 (2) 2 (3) 3 (4) **-3**

2280. Connor wants to compare Celsius and Fahrenheit temperatures by drawing a conversion graph. He knows that $-40^{\circ}\text{C} = -40^{\circ}\text{F}$ and that $20^{\circ}\text{C} = 68^{\circ}\text{F}$. On the accompanying grid, construct the conversion graph and, using the graph, determine the Celsius equivalent of 25°F .



(1) correct graph, and an answer between -6° and -2°

1502. What is the equation of the line in the accompanying graph?



- | | |
|----------------------------|-------------------|
| (1) $2y = x - 2$ | (3) $y = -2x - 2$ |
| (2) $y = \frac{1}{2}x + 1$ | (4) $y = 2x - 2$ |

2145. On a graph, which point is on the line of the equation $2x + 3y = 4$?

- | | |
|---------------|---------------|
| (1) $(-2, 5)$ | (3) $(5, -2)$ |
| (2) $(5, 2)$ | (4) $(-5, 2)$ |

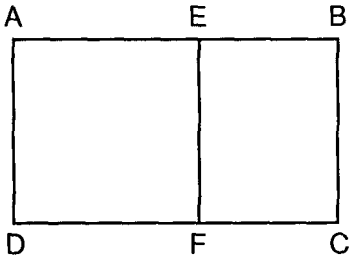
2175. The point whose coordinates are $(2, -3)$ is on the graph of the equation

- | | |
|-------------------|------------------|
| (1) $2x - 3y = 6$ | (3) $x + y = 5$ |
| (2) $3x + y = 3$ | (4) $x - y = -1$ |

IV. Ratios and Proportions

B. Similar Polygons and Right Triangles

2214. In the accompanying diagram, square $ADFE$ is inscribed in rectangle $ABCD$, $EB:AB = 3:7$, and the perimeter of $ABCD$ is 132.



Find:

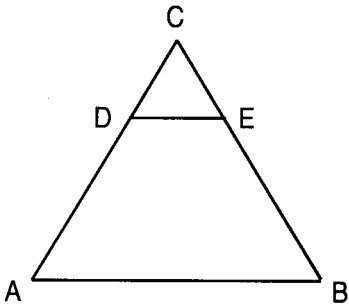
a the length of \overline{AE}

b the area of rectangle $ABCD$

c the ratio of the area of rectangle $EBCF$ to the area of rectangle $ABCD$, in simplest form

- a 24
- b 1,008
- c 3:7

1708. In the accompanying diagram of equilateral triangle ABC , $DE = 5$ and $\overline{DE} \parallel \overline{AB}$



If AB is three times as long as DE , what is the perimeter of quadrilateral $ABED$?

- (1) 20
- (2) 30
- (3) 35
- (4) 40

1701. If the radius of a circle is doubled, what change takes place in the circumference of the circle?

- (1) It remains the same.
- (2) It is multiplied by 2.
- (3) It is multiplied by 4.
- (4) It is multiplied by 8.

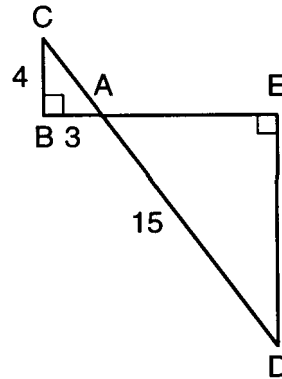
1. Similar Polygons

a. Lengths of Sides of Sim Polygons

1699. The lengths of the sides of $\triangle ABC$ are 4, 5, and 6. If the length of the longest side of similar triangle DEF is 18, find the length of the *shortest* side of $\triangle DEF$.

12

1693. In the accompanying diagram, \overline{BAE} , \overline{CAD} , $\angle B$ and $\angle E$ are right angles, $AB = 3$, $BC = 4$, and $AD = 15$.



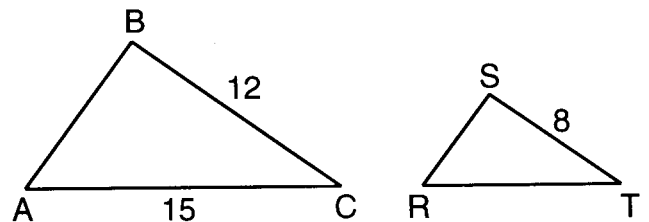
What is the length of \overline{DE} ?

- (1) 5
- (2) 8
- (3) 9
- (4) 12

1689. Two triangles are similar. The measure of the shortest side of the first triangle is 12 and the measure of the shortest side of the second triangle is 5. If the longest side of the first triangle measures 15, what is the measure of the longest side of the second triangle?

- (1) 2.4
- (2) 6.25
- (3) 24
- (4) 36

1677. In the accompanying diagram, $\triangle ABC$ is similar to $\triangle RST$, $BC = 12$, $AC = 15$, and $ST = 8$. Find RT .



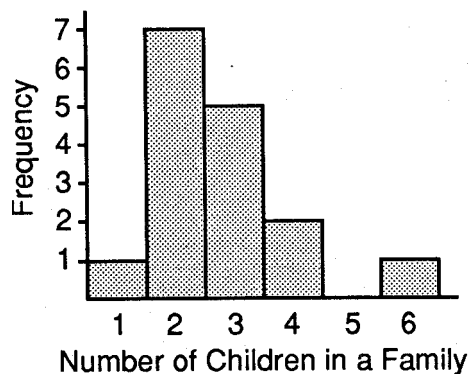
10

2029. A basketball team consists of 15 girls. The accompanying table shows the number of points each player scored in one season. Which interval contains the median for these data?

Interval	Frequency
101-120	1
81-100	4
61-80	2
41-60	3
21-40	3
0-20	2

41-60

2027. The histogram below shows the distribution of the number of children in the families of the students in a ninth-grade class.



The mode of the set of data in the histogram is

- (1) 5
- (2) 2
- (3) 3
- (4) 7

2017. In the set of scores below, how many scores are less than the mean?

32, 40, 42, 52, 59

3

2012. The mean of five numbers is 6. Find the sum of the five numbers.

30

2000. The scores 12, 17, 15, and x have a mean of 13. What is the value of x ?

8

2009. The accompanying frequency table shows data collected by the police in an automobile speed check.

Speed Interval	Frequency
66-75	45
56-65	110
46-55	120
36-45	25

Which interval contains the median speed?

- (1) 36-45
- (2) 46-55
- (3) 56-65
- (4) 66-75

2003. In a store, dress sizes range from 7 through 15. At inventory time, the sizes of one style of dress on the rack were: 7, 7, 9, 9, 9, 11, 11, 11, 13, 13, 13, 13, and 15. What is the mode?

13

1993. Find, in terms of x , the mean of $3x - 5$, $5x - 6$, and $4x + 11$.

$4x$

1992. A census taker visited 100 homes. The accompanying table shows the frequencies for the number of people living in each home. Which interval contains the median for these data?

Number of People Living in One Home

Interval	Frequency
1-2	40
3-4	39
5-6	16
7-8	5

3-4

1986. Given the set of numbers $\{30, 42, x, 50, 54, 80\}$. If the median is 49, what is the value of x ?

48