The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

# MATHEMATICS A

**Thursday,** June 15, 2006 — 1:15 to 4:15 p.m., only

**Print Your Name:** Imaginary Student

**Print Your School's Name:** www.jmap.org

**Print your name and the name of your school in the boxes above. Then turn to the last page of this booklet, which is the answer sheet for Part I. Fold the last page along the perforations and, slowly and carefully, tear off the answer sheet. Then fill in the heading of your answer sheet.**

**Scrap paper is not permitted for any part of this examination, but you may use the blank spaces in this booklet as scrap paper. A perforated sheet of scrap graph paper is provided at the end of this booklet for any question for which graphing may be helpful but is not required. You may remove this sheet from this booklet. Any work done on this sheet of scrap graph paper will *not* be scored. All work should be written in pen, except graphs and drawings, which should be done in pencil.**

**This examination has four parts, with a total of 39 questions. You must answer all questions in this examination. Write your answers to the Part I multiple-choice questions on the separate answer sheet. Write your answers to the questions in Parts II, III, and IV directly in this booklet. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc.**

**When you have completed the examination, you must sign the statement printed at the end of the answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet cannot be accepted if you fail to sign this declaration.**

**Notice. . .**

**A minimum of a scientific calculator, a straightedge (ruler), and a compass must be available for you to use while taking this examination.**

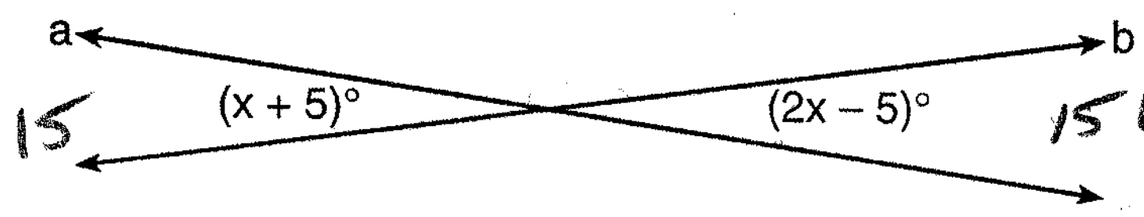
**The use of any communications device is strictly prohibited when taking this examination. If you use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.**

**DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.**

## Part I

**Answer all questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. For each question, write on the separate answer sheet the numeral preceding the word or expression that best completes the statement or answers the question.** [60]

**1** In the accompanying diagram, line $a$ intersects line $b$.




What is the value of $x$?

(1) –10
(2) 5
● 10
(4) 90

**Use this space for computations.**

$x + 5 = 2x - 5$
$-x \quad -x$
$5 = x - 5$
$+5 \quad +5$
$10 = x$

**2** What is the value of $x$ in the equation $13x - 2(x + 4) = 8x + 1$?

(1) 1
(2) 2
● 3
(4) 4

$13(3) - 2(3+4) = 8(3) + 1$
$39 - 2(7) = 24 + 1$
Check $39 - 14 = 25$
$25 = 25$ ✓

$13x - 2(x+4) = 8x + 1$
$13x - 2x - 8 = 8x + 1$
$11x - 8 = 8x + 1$
$-8x \quad -8x$
$3x - 8 = 1$
$+8 \quad +8$
$3x = 9$
$x = 3$

**3** One function of a movie projector is to enlarge the image on the film. This procedure is an example of a

(1) line of symmetry
(2) line reflection
(3) translation → moves by sliding
● dilation ↳ makes bigger or smaller, like the eyes dilating

↑ a mirror image

**4** What is the product of $\frac{1}{3}x^2y$ and $\frac{1}{6}xy^3$?

(1) $\frac{1}{2}x^2y^3$
(2) $\frac{1}{9}x^3y^4$
(3) $\frac{1}{18}x^2y^3$
● $\frac{1}{18}x^3y^4$

$\left(\frac{1}{3}\right)(x^2)(y)\left(\frac{1}{6}\right)(x)(y^3)$
$\left(\frac{1}{3}\right)\left(\frac{1}{6}\right)(x^2)(x)(y)(y^3)$
$\left(\frac{1}{18}\right)(x^3)(y^4)$

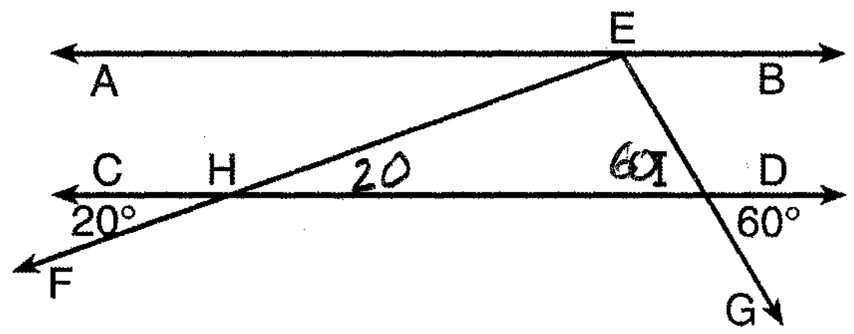
**5** What is the value of $\frac{8!}{4!}$?

● 1,680
(2) 2
(3) 2!
(4) 4!

$\frac{8 \cdot 7 \cdot 6 \cdot 5 \cdot \cancel{4 \cdot 3 \cdot 2 \cdot 1}}{\cancel{4 \cdot 3 \cdot 2 \cdot 1}} = \frac{1680}{1}$
$= 1680$

**Use this space for computations.**

**6** In the accompanying diagram, $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$. From point $E$ on $\overleftrightarrow{AB}$, transversals $\overrightarrow{EF}$ and $\overrightarrow{EG}$ are drawn, intersecting $\overleftrightarrow{CD}$ at $H$ and $I$, respectively.




If $m\angle CHF = 20$ and $m\angle DIG = 60$, what is $m\angle HEI$?

(1) 60
(2) 80
(3) 100
(4) 120

$180 - (20+60) = \angle HEI$
$180 - 80 = \angle HEI$
$100 = \angle HEI$

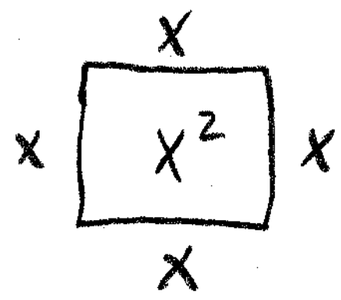
**7** Leo purchased five shirts, three pairs of pants, and four pairs of shoes. Which expression represents how many different outfits consisting of one shirt, one pair of pants, and one pair of shoes Leo can make?

(1) $5 \cdot 3 \cdot 4$
(2) $5 + 3 + 4$
(3) ${}_{12}C_3$
(4) ${}_{12}P_3$

Shirts Pants Shoes
5 × 3 × 4

**8** What is the length of one side of the square whose perimeter has the same numerical value as its area?

(1) 5
(2) 6
(3) 3
(4) 4




$4x = x^2$
$\frac{4x}{x} = \frac{x^2}{x}$
$4 = x$

Check
$4(4) = 4^2$
$16 = 16$ ✓

**9** Which list is in order from smallest value to largest value?

(1) $\sqrt{10}, \frac{22}{7}, \pi, 3.1$
(2) $3.1, \frac{22}{7}, \pi, \sqrt{10}$
(3) $\pi, \frac{22}{7}, 3.1, \sqrt{10}$
(4) $3.1, \pi, \frac{22}{7}, \sqrt{10}$

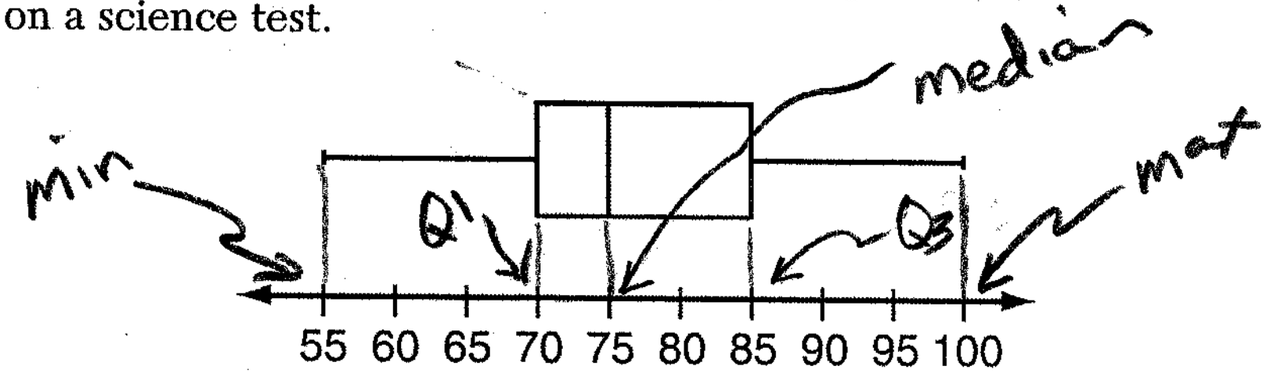
$\sqrt{10} = 3.162277766$
$\frac{22}{7} = 3.142857143$
$\pi = 3.14159$
$3.1 = 3.1$

next smallest
Smallest

$3.1 < \pi$

**Use this space for computations.**

**10** The accompanying box-and-whisker plot represents the scores earned on a science test.

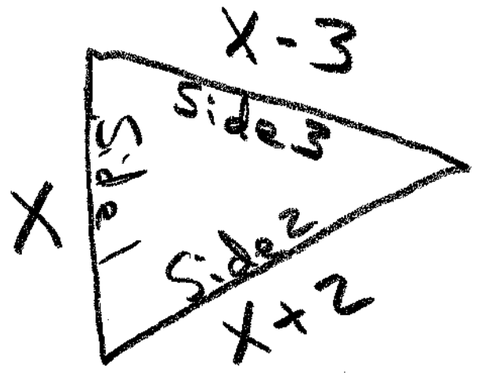



What is the median score?

(1) 70
(2) 75
(3) 77
(4) 85

**11** The second side of a triangle is two more than the first side, and the third side is three less than the first side. Which expression represents the perimeter of the triangle?

(1) $x + 5$
(2) $2x - 1$
(3) $3x - 1$
(4) $x^2 - x - 6$




$X + (X+2) + (X-3) = \text{Perimeter}$

$X + X + 2 + X - 3 = \text{Perimeter}$

$3X - 1 = P$

**12** What is the value of $x$ in the equation $\frac{x}{2x+1} = \frac{4}{3}$?

(1) $-\frac{1}{5}$
(2) $-\frac{4}{5}$
(3) $-\frac{5}{4}$
(4) $-5$

$\frac{X}{2X+1} = \frac{4}{3}$

$X(3) = (2X+1)\,4$

$3X = 8X + 4$

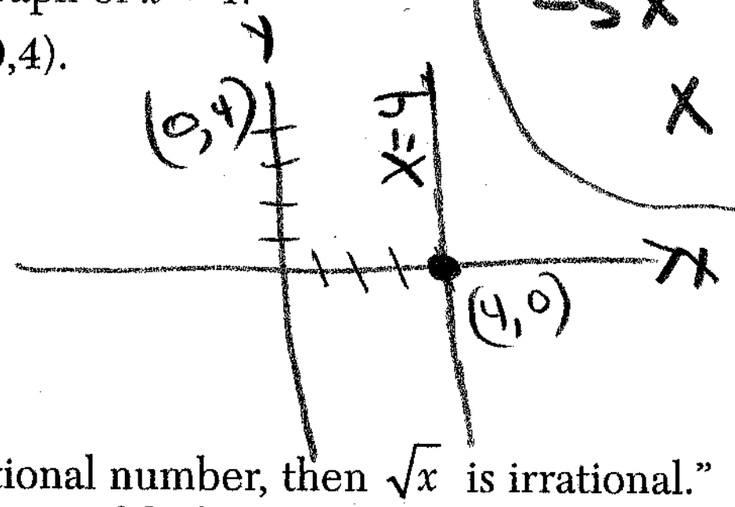
$-8X \quad -8X$

$-5X = 4$

$X = \frac{4}{-5}$

**13** Which statement describes the graph of $x = 4$?

(1) It passes through the point (0,4).
(2) It has a slope of 4.
(3) It is parallel to the $y$-axis.
(4) It is parallel to the $x$-axis.




**14** Given the statement: "If $x$ is a rational number, then $\sqrt{x}$ is irrational." Which value of $x$ makes the statement *false*?

(1) $\frac{3}{2}$
(2) 2
(3) 3
(4) 4

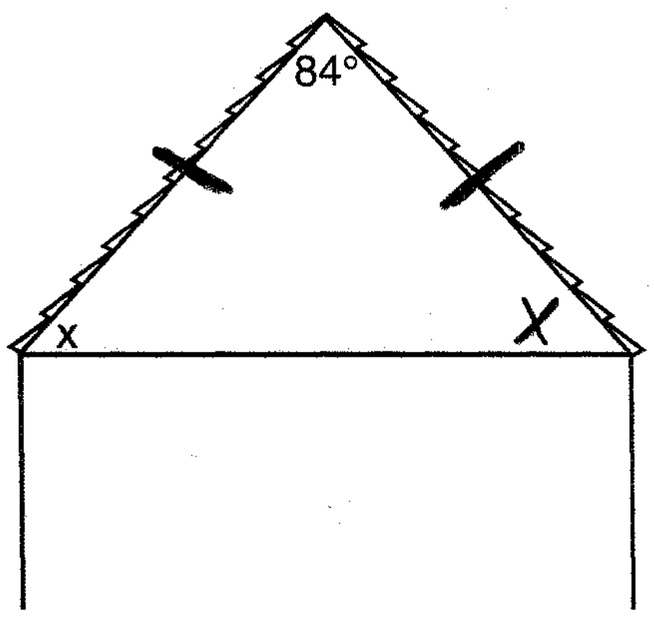
$X = 4$

$\sqrt{4} = 2$

2 is not irrational, since it can be expressed as $\frac{2}{1}$, which is a ratio of 2 integers.

2 equal sides

**15** The accompanying diagram shows the roof of a house that is in the shape of an isosceles triangle. The vertex angle formed at the peak of the roof is 84°.




What is the measure of $x$?

(1) 138°
(2) 96°
(3) 84°
● 48°

**Use this space for computations.**

$x + x + 84 = 180$

$2x + 84 = 180$

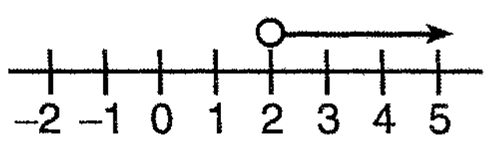
$-84 \quad -84$

$2x = 96$

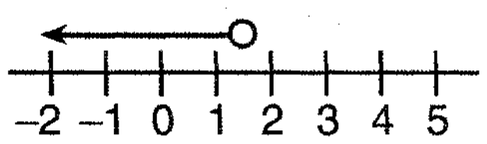
$x = \frac{96}{2}$

$x = 48$

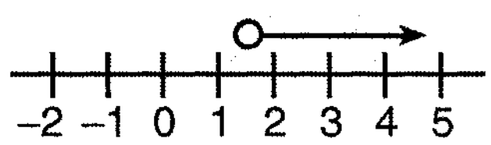
**16** Which graph best represents the solution set for the inequality $x > \sqrt{2}$ ?



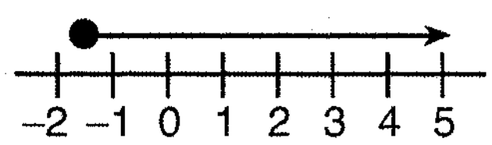
(1)



(3)



● (2)



(4)

$x > \sqrt{2}$

$x > 1.414213562\ldots$

**17** The formula for the volume of a right circular cylinder is $V = \pi r^2 h$. The value of $h$ can be expressed as

(1) $\frac{V}{\pi} r^2$
(3) $\frac{\pi r^2}{V}$
● (2) $\frac{V}{\pi r^2}$
(4) $V - \pi r^2$

$V = (\pi r^2) h$

$\frac{V}{(\pi r^2)} = \frac{(\pi r^2) h}{(\pi r^2)}$

$\frac{V}{\pi r^2} = h$

slope = $\frac{\text{rise}}{\text{run}} = \frac{0}{\infty} = 0$

**18** If a line is horizontal, its slope is

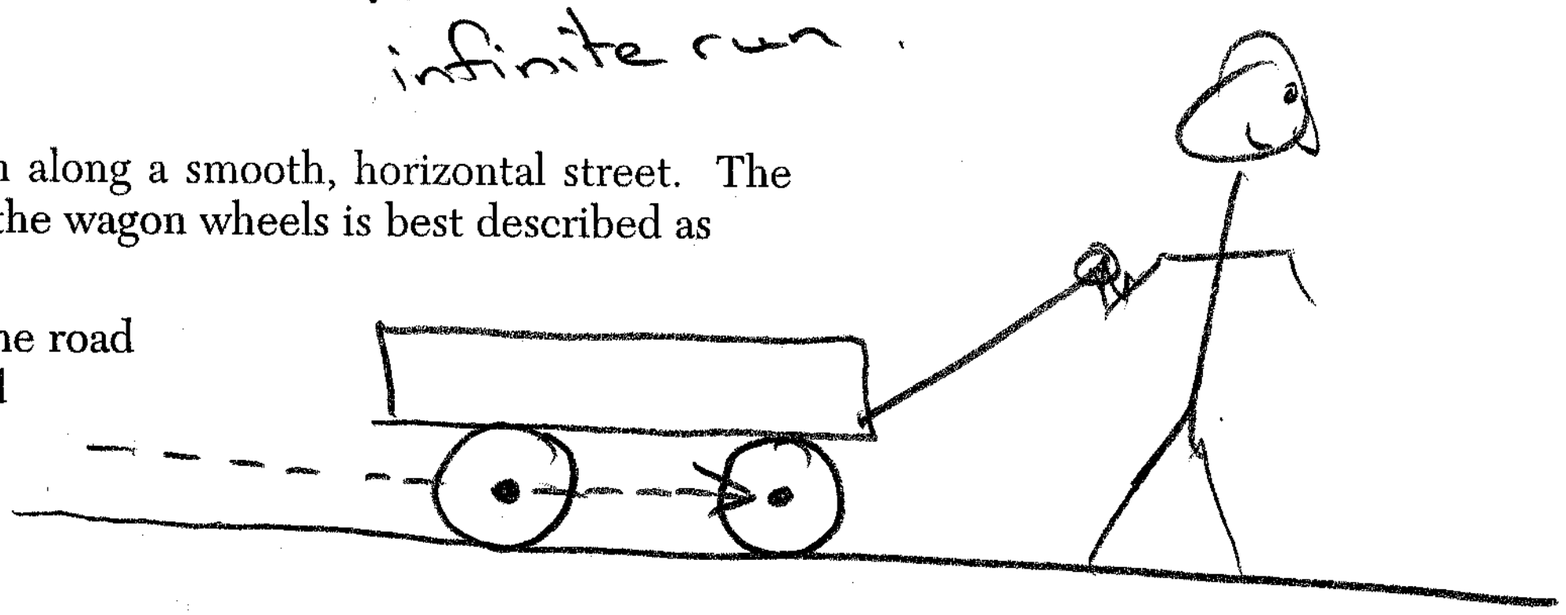
(1) 1
(2) 0
(3) undefined
(4) negative

horizontal lines have zero rise, infinite run.

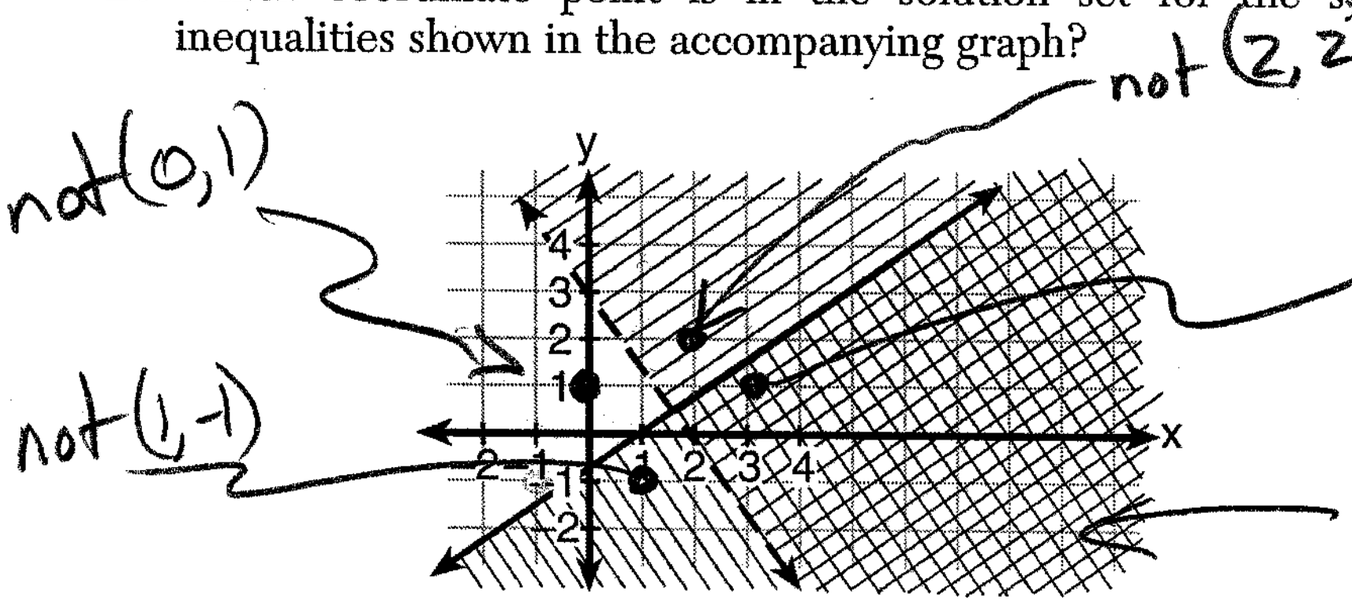
**Use this space for computations.**

**19** Chantrice is pulling a wagon along a smooth, horizontal street. The path of the center of one of the wagon wheels is best described as

(1) a circle
(2) a line perpendicular to the road
(3) a line parallel to the road
(4) two parallel lines



**20** Which coordinate point is in the solution set for the system of inequalities shown in the accompanying graph?




(1) (3,1)
(2) (2,2)
(3) (1,–1)
(4) (0,1)

**21** The measures of two complementary angles are represented by $(3x + 15)$ and $(2x - 10)$. What is the value of $x$?

(1) 17
(2) 19
(3) 35
(4) 37

Complementary angles sum to 90°

$3x+15+2x-10=90$
$5x+5=90$
$5x=85$
$x=17$

Check
$3(17)+15+2(17)-10=90$
$51+15+34-10=90$
$66+34-10=90$
$100-10=90$
$90=90$ ✓

**22** If $x = 3$, which statement is *false*?

(1) $x$ is prime and $x$ is odd. True
(2) $x$ is odd or $x$ is even. True
(3) $x$ is not prime and $x$ is odd.
(4) $x$ is odd and $2x$ is even. True

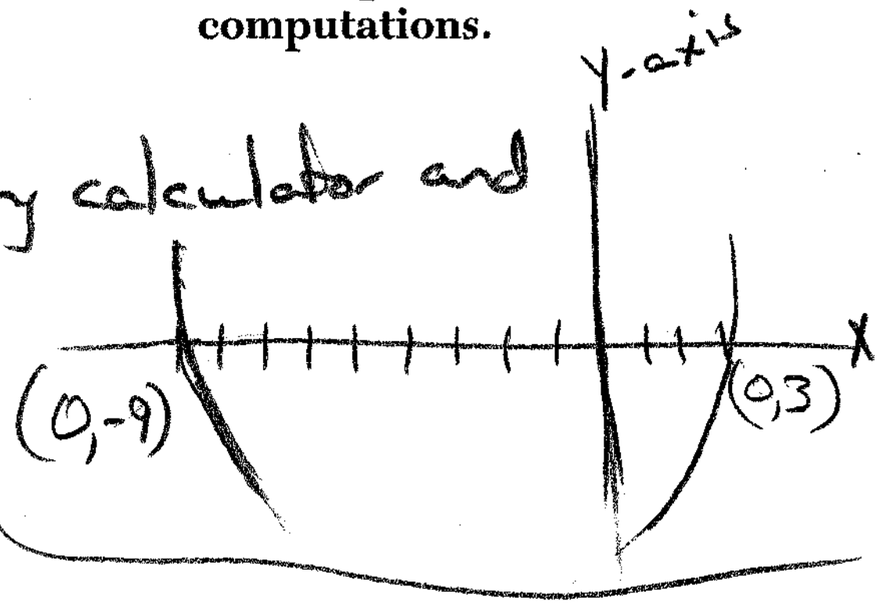
$2y^2+12y-54 \Rightarrow 2(y^2+6y-27) \Rightarrow 2(y+9)(y-3)$

**23** Factored completely, the expression $2y^2 + 12y - 54$ is equivalent to

(1) $2(y + 9)(y - 3)$ (3) $(y + 6)(2y - 9)$
(2) $2(y - 3)(y - 9)$ (4) $(2y + 6)(y - 9)$

**Use this space for computations.**

Strategy) Plug $2y^2+12y-54$ into graphing calculator and look at the graph




**24** Which statement best illustrates the additive identity property?

~~(1)~~ $6 + 2 = 2 + 6$ Commutative
~~(2)~~ $6(2) = 2(6)$ Not Addition
~~(3)~~ $6 + (-6) = 0$ Additive Inverse
(4) $6 + 0 = 6$

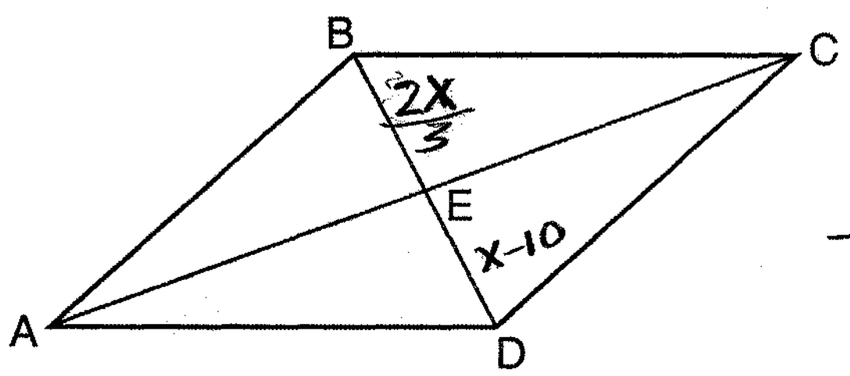
**25** The expression $\frac{5x}{6} + \frac{x}{4}$ is equivalent to

(1) $\frac{3x}{5}$ (3) $\frac{13x}{12}$
(2) $\frac{5x^2}{10}$ (4) $\frac{5x}{24}$

$\frac{5x}{6} + \frac{x}{4}$

$\frac{5x(4) + 6(x)}{6 \times 4} \rightarrow \frac{20x + 6x}{24} \rightarrow \frac{26x}{24} \rightarrow \frac{13x}{12}$

**26** In the accompanying diagram of parallelogram $ABCD$, diagonals $\overline{AC}$ and $\overline{BD}$ intersect at $E$, $BE = \frac{2}{3}x$, and $ED = x - 10$.




What is the value of $x$?

(1) –30 (3) –6
(4) 6

$\frac{2x}{3} = \frac{x-10}{1}$

$2x = 3(x-10)$

$2x = 3x - 30$

$-3x \quad -3x$

$-x = -30$

$x = 30$

Check

$\frac{2(30)}{3} = (30-10)$

$\frac{60}{3} = 20$

$20 = 20$ ✓

**27** Expressed in simplest radical form, the product of $\sqrt{6} \bullet \sqrt{15}$ is

(1) $\sqrt{90}$
(3) $9\sqrt{10}$
● $3\sqrt{10}$
(4) $3\sqrt{15}$

**Use this space for computations.**

$\sqrt{6} \cdot \sqrt{15}$

$\sqrt{3}\sqrt{2} \cdot \sqrt{3}\sqrt{5}$

$\sqrt{3}\sqrt{3}\sqrt{2}\sqrt{5}$

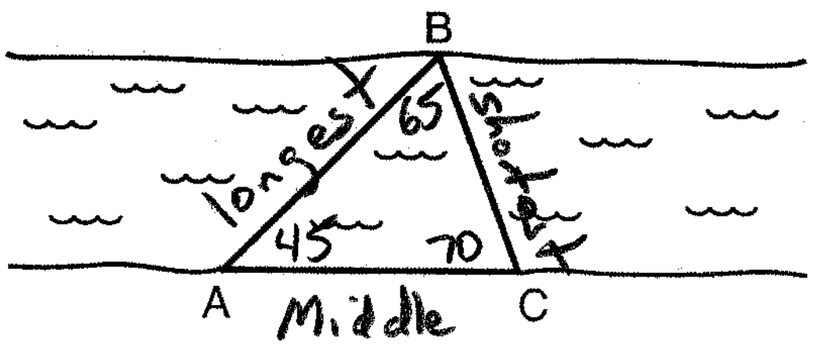
$3\sqrt{10}$

**28** What is the sum of $6 \times 10^3$ and $3 \times 10^2$?

● $6.3 \times 10^3$
(3) $9 \times 10^6$
(2) $9 \times 10^5$
(4) $18 \times 10^5$

$6000 + 300 = 6300 = 6.3 \times 10^3$

**29** On the banks of a river, surveyors marked locations $A$, $B$, and $C$. The measure of $\angle ACB = 70°$ and the measure of $\angle ABC = 65°$.




Which expression shows the relationship between the lengths of the sides of this triangle?

(1) $AB < BC < AC$
● $BC < AC < AB$
(2) $BC < AB < AC$
(4) $AC < AB < BC$

$BC < AC < AB$

Longest side is opposite the biggest ∠.
Shortest side is opposite the smallest ∠.

**30** Which inequality represents the probability, $x$, of any event happening?

(1) $x \geq 0$
(3) $x < 1$
(2) $0 < x < 1$
● $0 \leq x \leq 1$

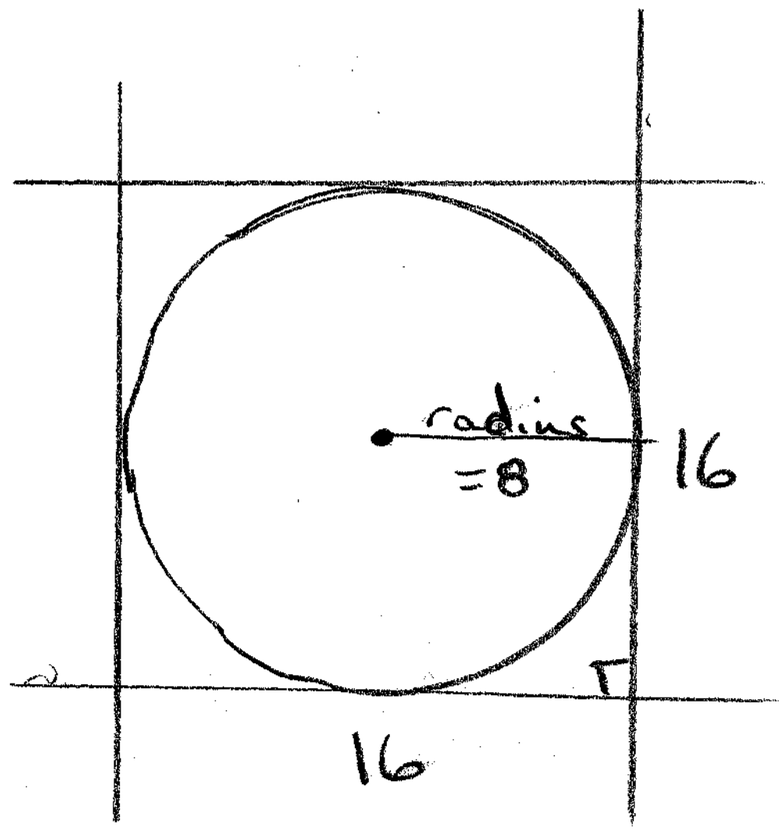
Zero is the lowest probability possible. (won't happen)

One is the highest probability possible. (will definitely happen)

## Part II

**Answer all questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit.** [10]

**31** Determine the area, in square feet, of the *smallest* square that can contain a circle with a radius of 8 feet.




Diameter = 16 ft.

$A_{\square} = (16)(16)$

$A_{\square} = \boxed{256\ ft^2}$

**32** Five friends met for lunch, and they all shook hands. Each person shook the other person's right hand only once. What was the total number of handshakes?

$${}_5C_2 = \frac{5 \cdot 4}{2 \cdot 1} = \frac{20}{2} = \boxed{10}$$

Answer

**33** Two hikers started at the same location. One traveled 2 miles east and then 1 mile north. The other traveled 1 mile west and then 3 miles south. At the end of their hikes, how many miles apart are the two hikers? [The use of the accompanying grid is optional.]

$a^2 + b^2 = c^2$

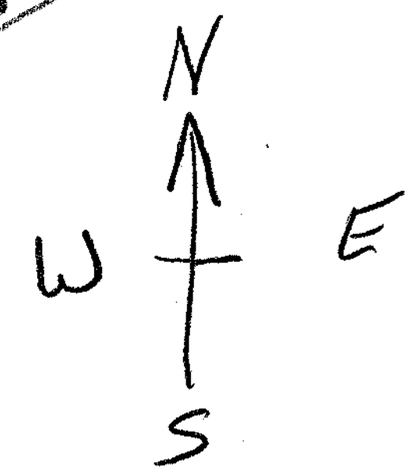
$3^2 + 4^2 = c^2$

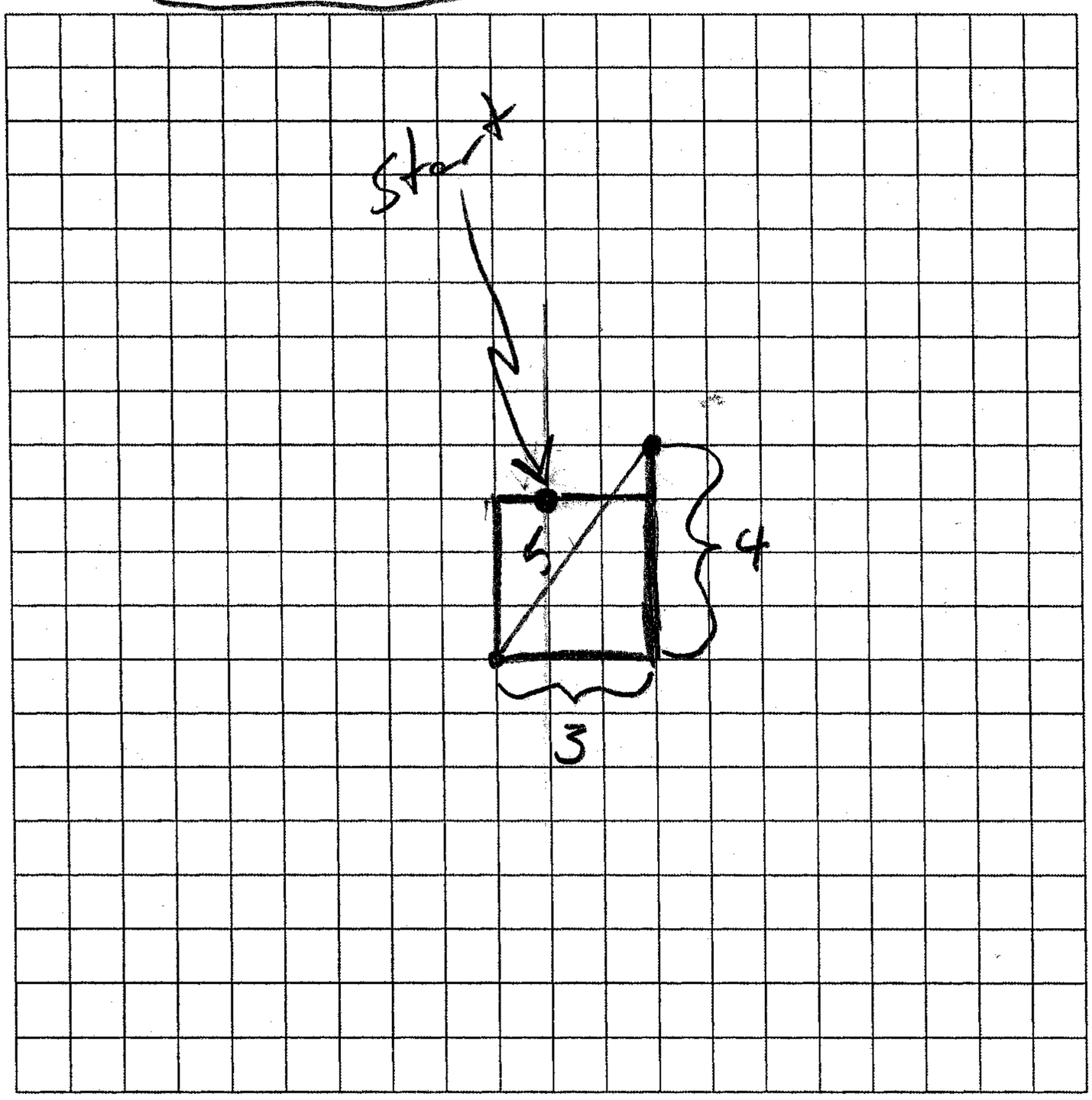
$9 + 16 = c^2$

$25 = c^2$

$5 = c$

The hikers were 5 miles apart



**34** Solve for $x$: $3.3 - x = 3(x - 1.7)$

$3.3 - X = 3(X - 1.7)$

$3.3 - X = 3X - 5.1$

$+X \quad +X$

$3.3 = 4X - 5.1$

$+5.1 \quad +5.1$

$8.4 = 4X$

$\frac{8.4}{4} = \frac{4X}{4}$

$2.1 = X$

Answer

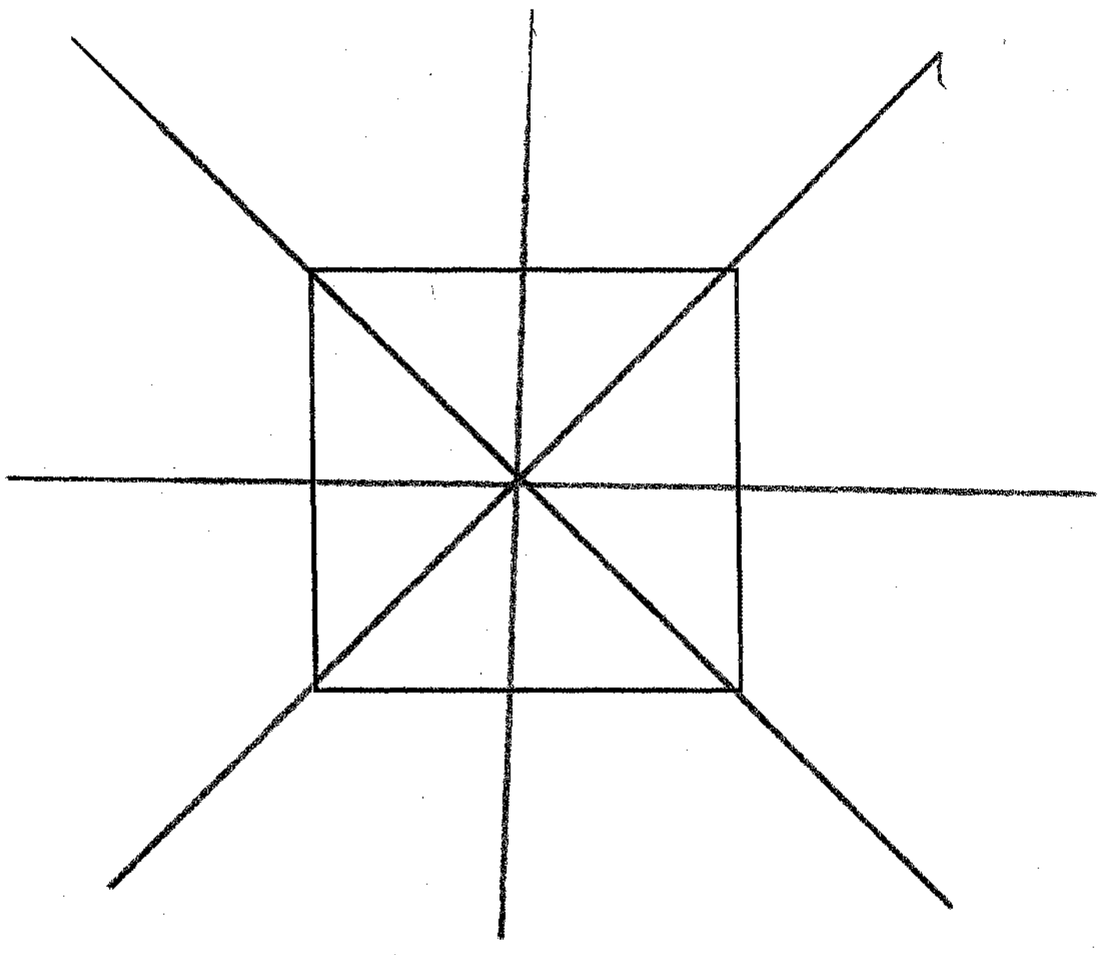
Check

$3.3 - (2.1) = 3(2.1 - 1.7)$

$1.2 = 3(.4)$

$1.2 = 1.2$ ✓

**35** On the accompanying square, draw all the lines of symmetry.



## Part III

**Answer all questions in this part. Each correct answer will receive 3 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit.** [6]

**36** Tamara has two sisters. One of the sisters is 7 years older than Tamara. The other sister is 3 years younger than Tamara. The product of Tamara's sisters' ages is 24. How old is Tamara?

Let T = Tamara's age

Let T+7 = Tamara's older sister

Let T-3 = Tamara's younger sister

$(T+7)(T-3) = 24$

$T^2 - 3T + 7T - 21 = 24$

$T^2 + 4T - 21 = 24$

$-24 \quad -24$

$T^2 + 4T - 45 = 0$

$(T+9)(T-5) = 0$

$T+9 = 0$ $\qquad$ $T-5 = 0$

$T = -9$ $\qquad$ $T = 5$

This age is not possible

Tamara is 5 years old.

Check

5

12

2

$12 \times 2 = 24$ ✓

37 Sara's test scores in mathematics were 64, 80, 88, 78, 60, 92, 84, 76, 86, 78, 72, and 90. Determine the mean, the median, and the mode of Sara's test scores.

60, 64, 72, 76, 78, 78 | 80, 84, 86, 88, 90, 92

mode: 78, 78

median: between 78 and 80

$n = 12$

$$\text{Mean} = \frac{60+64+72+76+78+78+80+84+86+88+90+92}{12}$$

mean = 79

$$\text{median} = \frac{78+80}{2} = 79$$

mode = 78

## Part IV

**Answer all questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit.** [8]

**38** Sharu has \$2.35 in nickels and dimes. If he has a total of thirty-two coins, how many of *each* coin does he have?

Let $n$ = # of nickles

Let $d$ = # of dimes

$n + d = 32 \Rightarrow d = 32 - n$

$5n + 10d = 235$ (cents)

$5n + 10(32 - n) = 235$

$5n + 320 - 10n = 235$

$-5n + 320 = 235$

$-320 \quad -320$

$\frac{-5n}{-5} = \frac{-85}{-5}$

$n = 17$

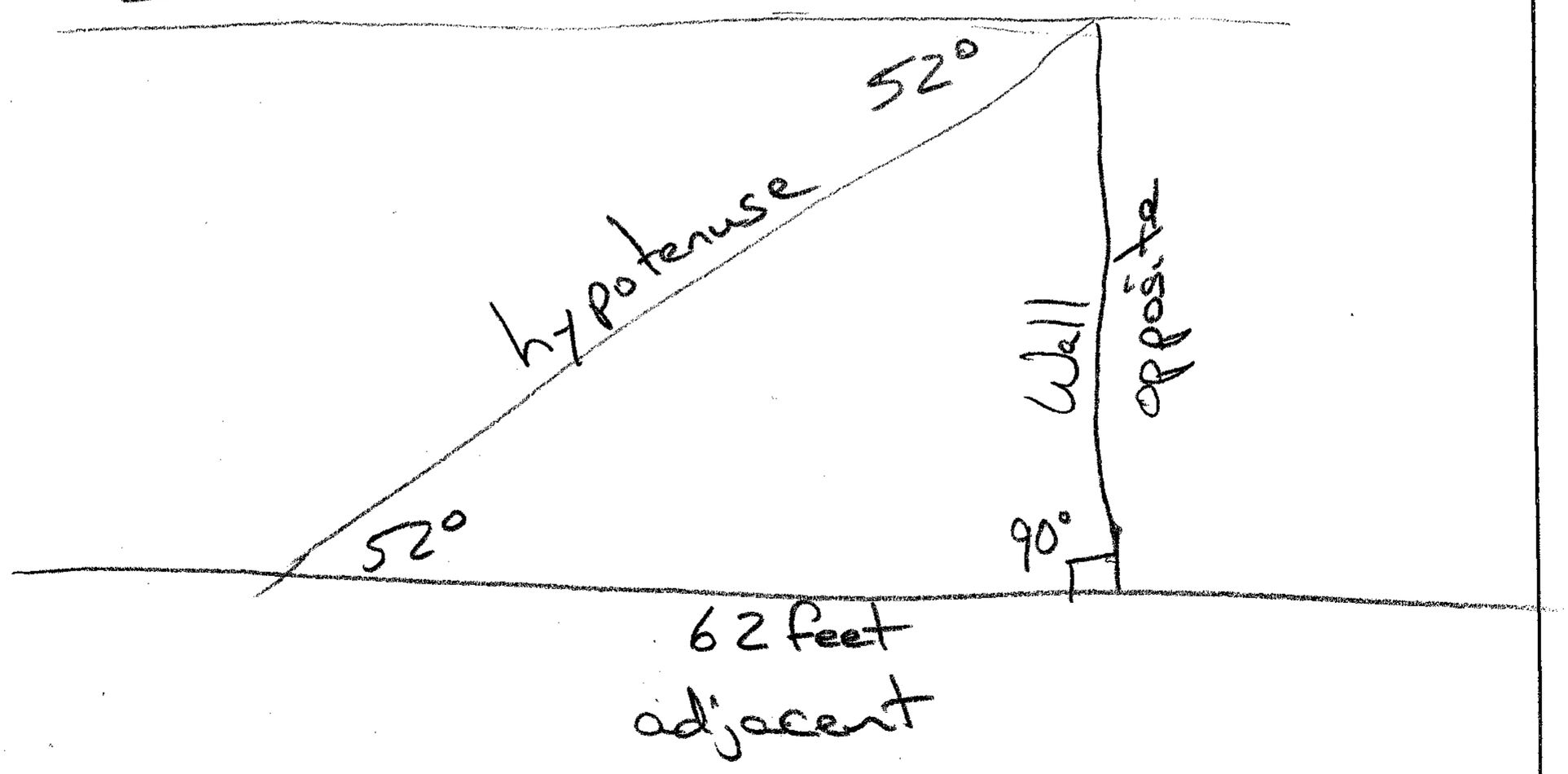
Sharu had 17 nickles — 85¢

$d = 32 - 17 = 15$

Sharu had 15 dimes — 150¢

Check: 85¢ + 150¢ = 235¢ ✓

**39** A person measures the angle of depression from the top of a wall to a point on the ground. The point is located on level ground 62 feet from the base of the wall and the angle of depression is 52°. How high is the wall, to the *nearest tenth of a foot*?




SOH-CAH-TOA

$$\text{Tan } 52° = \frac{\text{opp}}{\text{adj}} = \frac{\text{opp}}{62}$$

$$\frac{\text{Tan } 52°}{1} = \frac{\text{opp}}{62}$$

$$\text{Tan } 52\,(62) = \text{opp}$$

$$79.3563812 = \text{opp}$$

79.4 ft