The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

MATHEMATICS A

Wednesday, August 16, 2006 — 8:30 to 11:30 a.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.

MATHEMATICS A

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]

Use this space for computations.

1 While solving the equation $4(x + 2) = 28$, Becca wrote $4x + 8 = 28$. Which property did she use?

(1) distributive
(2) associative
(3) commutative
(4) identity

8
4x
$4(x+2) = 28$
$4x + 8 = 28$

2 What is the value of p in the equation $2(3p - 4) = 10$?

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

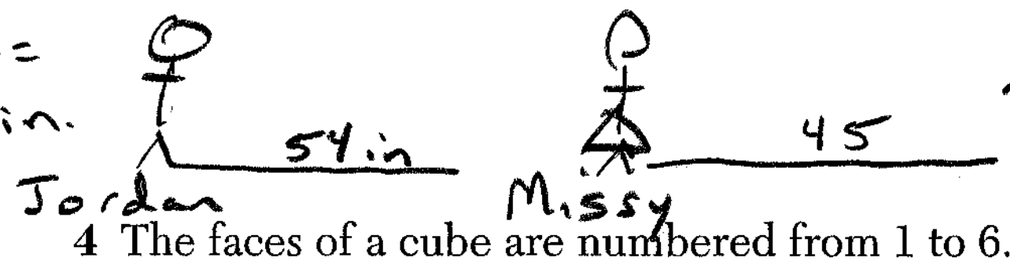
Dist Prop
Add 8
Divide by 6
Answer

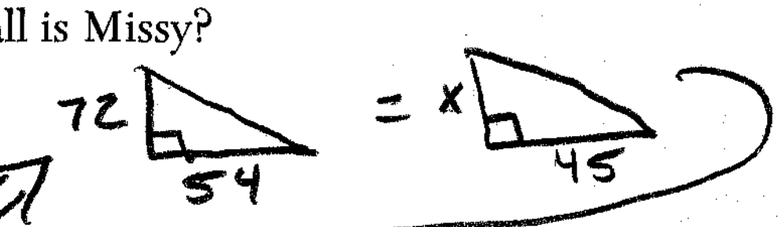
$2(3p-4)$	=	10
$6p - 8$	=	10
$+8$		$+8$
$6p$	=	18
p	=	3

3 Jordan and Missy are standing together in the schoolyard. Jordan, who is 6 feet tall, casts a shadow that is 54 inches long. At the same time, Missy casts a shadow that is 45 inches long. How tall is Missy?

(1) 38 in
(2) 86.4 in
(3) 5 ft
(4) 5 ft 6 in

6 ft = 72 in.





Height / Shadow

$\frac{72}{54} = \frac{x}{45} \Rightarrow 72(45) = 54(x)$

$3240 = 54x$

$60 = x$

60 in = 5 ft.

4 The faces of a cube are numbered from 1 to 6. What is the probability of *not* rolling a 5 on a single toss of this cube?

(1) $\frac{1}{6}$
(2) $\frac{5}{6}$
(3) $\frac{1}{5}$
(4) $\frac{4}{5}$

$P(\text{event}) = \frac{\#\text{ times event happens}}{\text{total possible outcomes}} \Rightarrow 5_{(1,2,3,4,6)} = \frac{5}{6}$
(not 5)

5 What is the product of $10x^4y^2$ and $3xy^3$?

(1) $30x^4y^5$
(2) $30x^4y^6$
(3) $30x^5y^5$
(4) $30x^5y^6$

$(10x^4y^2)\,3xy^3$

$(10)(x^4)(y^2)(3)(x)(y^3)$

$(10)(3)(x^4)(x)(y^2)(y^3)$

$(30)(x^{(4+1)})(y^{(2+3)})$

$30(x^5)(y^5)$

$30x^5y^5$

[2]

$D+Q+N=52$

Use this space for computations.

6 Sal keeps quarters, nickels, and dimes in his change jar. He has a total of 52 coins. He has three more quarters than dimes and five fewer nickels than dimes. How many dimes does Sal have?

(1) 13
(2) 18
(3) 20
(4) 21

Let D = dimes
Q = quarters
N = nickles

Quarters = D + 3
Nickles = D − 5
Dimes = D

$D+Q+N=52$
$D+D+3+D-5=52$
$3D-2=52$
$3D=54$
$D=18$

Check #Q = 21
#N = 13
#D = 18
Total = 52 ✓

7 A micron is a unit used to measure specimens viewed with a microscope. One micron is equivalent to 0.00003937 inch. How is this number expressed in scientific notation?

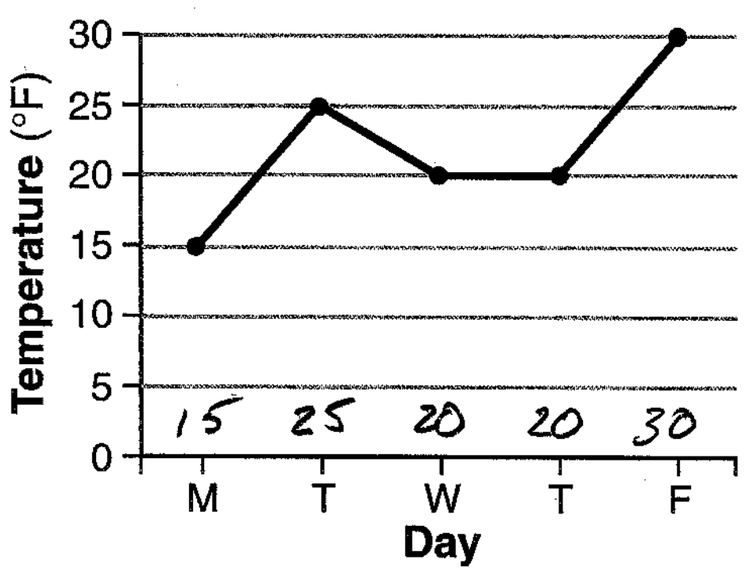
(1) 3.937×10^{-5}
(2) 3.937×10^{5}
(3) 3937×10^{-8}
(4) 3937×10^{8}

0.00003937
1 2 3 4 5

Moving the decimal left is positive. Moving the decimal right is negative

3.937×10^{-5}

8 The accompanying graph shows the high temperatures in Elmira, New York, for a 5-day period in January.



Which statement describes the data?

(1) median = mode
(2) median = mean
(3) mean < mode
(4) mean = mode

$\text{Mean} = \frac{15+25+20+20+30}{5} = \frac{110}{5}$

$= 22$

Median 15, 20, 20, 25, 30
↑ middle # = 20

Mode 15, 20, 20, 25, 30
Most common # = 20

∴ Median = Mode

9 What is the image of point (–3,4) under the translation that shifts (x,y) to $(x-3, y+2)$?

(1) (0,6)
(2) (6,6)
(3) (–6,8)
(4) (–6,6)

(x, y)
(−3, 4)
(x−3, y+2)
(−3−3, 4+2)
(−6, 6)

Use this space for computations.

10 For which value of x is the expression $\frac{3}{x-2}$ undefined?

(1) -2
(2) 2
(3) 3
(4) 0

an expression is undefined when its denominator = 0

$x - 2 = 0$

$x = 2$

When $x = 2$, the expression $\frac{3}{x-2}$ has a 0 for a denominator.

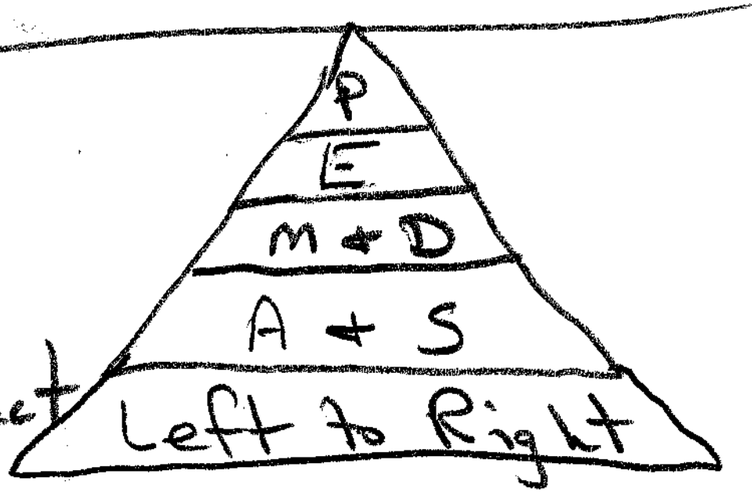
11 Which transformation does *not* always result in an image that is congruent to the original figure?

(1) dilation
(2) reflection
(3) rotation
(4) translation

same shape, but different size

12 What is the first step in simplifying the expression $(2 - 3 \times 4 + 5)^2$?

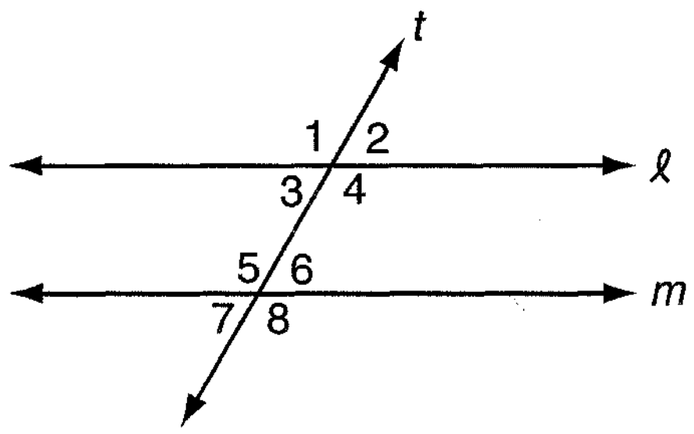
(1) square 5
(2) add 4 and 5
(3) subtract 3 from 2
(4) multiply 3 by 4



P - focus inside parenthesis first

M+D - Do multiplication + division before add/subtract

13 In the accompanying diagram, line ℓ is parallel to line m, and line t is a transversal.



Which must be a true statement?

(1) $m\angle 1 + m\angle 4 = 180$
(2) $m\angle 1 + m\angle 8 = 180$
(3) $m\angle 3 + m\angle 6 = 180$
(4) $m\angle 2 + m\angle 5 = 180$

Vertical Angles

Alternate Exterior Angles

Alternate Interior Angles

Corresponding Angles

Supplementary Angles

$m\angle 2 = m\angle 6$

$m\angle 6 + m\angle 5 = 180°$

$\therefore m\angle 2 + m\angle 5 = 180°$

14 What is the sum of $\sqrt{50}$ and $\sqrt{32}$?

(1) $\sqrt{82}$
(2) $20\sqrt{20}$
(3) $9\sqrt{2}$
(4) $\sqrt{2}$

$\sqrt{50} + \sqrt{32}$

$\sqrt{2}\sqrt{25} + \sqrt{2}\sqrt{16}$

$\sqrt{2}(5) + \sqrt{2}(4)$

$5\sqrt{2} + 4\sqrt{2}$

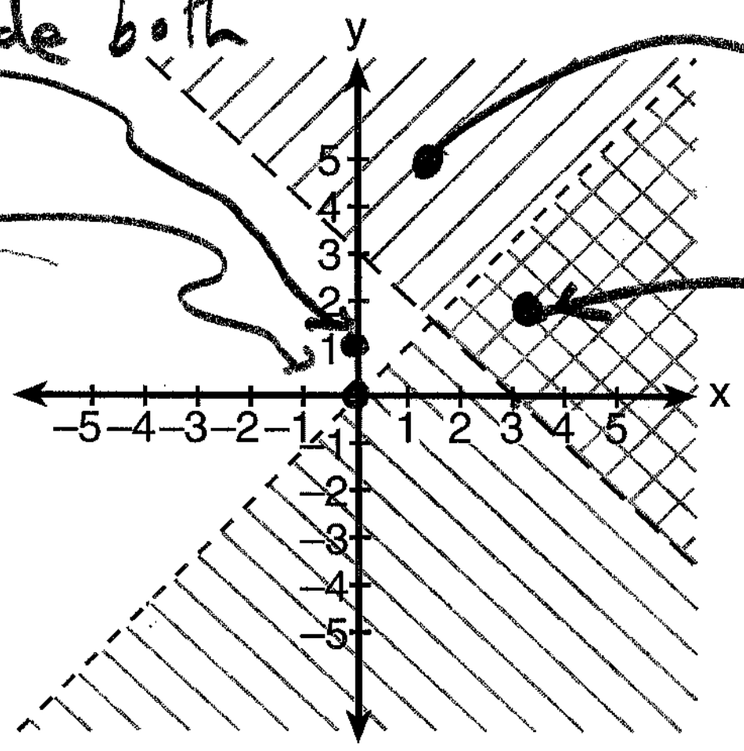
$9\sqrt{2}$

Use this space for computations.

15 Which ordered pair is in the solution set of the system of inequalities shown in the accompanying graph?

(0,1) outside both

(0,0) on dotted line



(1,5) in solution area of only 1 inequality

(3,2) is in solution area of both inequalities

~~(1) (0,0)~~
~~(2) (0,1)~~
~~(3) (1,5)~~
(4) (3,2)

16 Julia has four different flags that she wants to hang on the wall of her room. How many different ways can the flags be arranged in a row?

(1) 1
(2) 10
(3) 16
(4) 24

Flag 1 Choices: 4 × Flag 2 Choices: 3 × Flag 3 Choices: 2 × Flag 4 Choices: 1 = 24

Order Matters $\Rightarrow {}_4P_4 = 24$

17 If $x = 4$ and $y = -2$, the value of $\frac{1}{2}xy^2$ is

(1) 32
(2) 8
(3) –4
(4) –8

$x = 4$

$y = -2$

$\frac{1}{2}(x)(y)^2$

$\frac{1}{2}(4)(-2)^2$

$\frac{1}{2}(16)$

8

18 The measures of two consecutive angles of a parallelogram are in the ratio 5:4. What is the measure of an obtuse angle of the parallelogram?

(1) 20°
(2) 80°
(3) 100°
(4) 160°

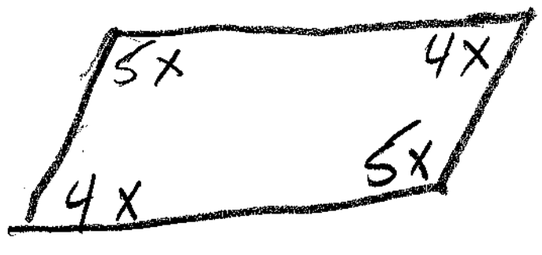
Two consecutive $\angle$s of any parallelogram sum to 180°

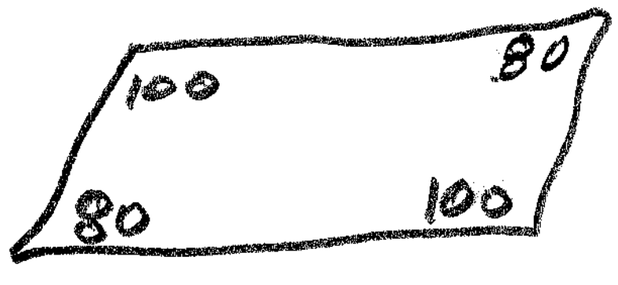
$5x / 4x$

$9x = 180°$

$x = 20°$

$4x = 80°$ $5x = 100°$





19 The graph of the equation $x + 3y = 6$ intersects the y-axis at the point whose coordinates are

(1) (0,2)
(2) (0,6)
(3) (0,18)
(4) (6,0)

y-intercept occurs when X = 0

Use this space for computations.

$x + 3y = 6$
$0 + 3y = 6$
$3y = 6$
$y = 2$

20 What is the value of w in the equation $\frac{3}{4}w + 8 = \frac{1}{3}w - 7$?

(1) 2.4
(2) –0.2
(3) –13.846
(4) –36

$\frac{3}{4} - \frac{1}{3}$
$\frac{9-4}{12} \Rightarrow \frac{5}{12}$

$\frac{3}{4}w + 8 = \frac{1}{3}w - 7$
$-\frac{1}{3}w \quad -\frac{1}{3}w$
$\frac{5}{12}w + 8 = -7$
$-8 \quad -8$
$\frac{5}{12}w = -15$

$\frac{5}{12}w = -15$
$5w = -180$
$w = -36$

21 Which list shows the numbers $|-0.12|$, $\sqrt{\frac{1}{82}}$, $\frac{1}{8}$, and $\frac{1}{9}$ in order from smallest to largest?

(1) $|-0.12|, \frac{1}{8}, \frac{1}{9}, \sqrt{\frac{1}{82}}$
(2) $\frac{1}{8}, \frac{1}{9}, \sqrt{\frac{1}{82}}, |-0.12|$
(3) $\sqrt{\frac{1}{82}}, |-0.12|, \frac{1}{9}, \frac{1}{8}$
(4) $\sqrt{\frac{1}{82}}, \frac{1}{9}, |-0.12|, \frac{1}{8}$

$\sqrt{\frac{1}{82}}, \frac{1}{9}, |-0.12|, \frac{1}{8}$

next largest: $|-0.12| = .12$
$\frac{1}{8}$
largest: $.125$

$\sqrt{\frac{1}{82}}$ smallest
$.11043...$
$\frac{1}{9}$
next smallest: $.111\overline{1}$

22 One of the roots of the equation $x^2 + 3x - 18 = 0$ is 3. What is the other root?

(1) 15
(2) 6
(3) –6
(4) –21

Check
Plug $x^2+3x-18$ into a graphing calculator.
X-intercepts are 3 and -6

$X = 3$
$X - 3 = 0$
$(X-3)(X+\underline{3}) = X^2 + 3X - 18$
$? = 6$
$X + 6 = 0$
$X = -6$

23 The expression $2x^2 - x^2$ is equivalent to

(1) x^0
(2) 2
(3) x^2
(4) $-2x^4$

$2X^2$
$-\ 1X^2$
X^2

Use this space for computations.

24 The coordinates of A are (–9,2) and the coordinates of G are (3,14). What are the coordinates of the midpoint of $\overline{AG}$?

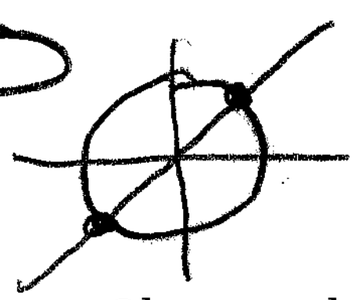
(1) (–3,8)
(2) (–6,6)
(3) (–6,16)
(4) (–21,–10)

$mp = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right) \Rightarrow mp = \left(\frac{-9+3}{2}, \frac{2+14}{2}\right) \Rightarrow mp = \left(\frac{-6}{2}, \frac{16}{2}\right)$

$mp = (-3, 8)$

25 What is the total number of points of intersection of the graphs of the equations $x^2 + y^2 = 16$ and $y = x$?

(1) 1
(2) 2
(3) 3
(4) 4



$x^2+y^2=16$ is circle with center at origin and radius = 4

$y = x$ is line through origin with slope = 1

26 In the next Olympics, the United States can enter four athletes in the diving competition. How many different teams of four divers can be selected from a group of nine divers?

(1) 36
(2) 126
(3) 3,024
(4) 6,561

$${}_9C_4 = \frac{9 \cdot 8 \cdot 7 \cdot 6}{4 \cdot 3 \cdot 2 \cdot 1} = \frac{126}{1}$$

27 When Albert flips open his mathematics textbook, he notices that the product of the page numbers of the two facing pages that he sees is 156. Which equation could be used to find the page numbers that Albert is looking at?

multiply ⇒

(1) $x + (x + 1) = 156$
(2) $(x + 1) + (x + 2) = 156$
(3) $(x + 1)(x + 3) = 156$
(4) $x(x + 1) = 156$

Let (x) = left page #
Let $(x+1)$ = right page #
$(x)(x+1) = 156$

28 Point $(k,-3)$ lies on the line whose equation is $x - 2y = -2$. What is the value of k?

(1) –8
(2) –6
(3) 6
(4) 8

$x - 2y = -2$

$(k, -3)$

$k - 2(-3) = -2$
$k + 6 = -2$
$-6 \quad -6$
$k = -8$

Use this space for computations.

29 Which statement is logically equivalent to the statement "If Corey worked last summer, he buys a car"?

Contra-Pos. → (1) If Corey does not buy a car, he did not work last summer.
Converse (2) If Corey buys a car, he worked last summer.
Inverse (3) If Corey did not work last summer, he does not buy a car.
2 (4) If Corey buys a car, he did not work last summer.

The contra-positive is logically equivalent to a given statement

30 Which line is perpendicular to the line whose equation is $5y + 6 = -3x$?

(1) $y = -\frac{5}{3}x + 7$
(2) $y = \frac{5}{3}x + 7$
(3) $y = -\frac{3}{5}x + 7$
(4) $y = \frac{3}{5}x + 7$

$5y + 6 = -3x$
$5y = -3x - 6$
$y = \frac{-3}{5}x - \frac{6}{5}$
$m = -\frac{3}{5}$
$\perp m = \frac{5}{3}$

Given

If Corey worked last summer, then he buys a car

If 1 , then 2

Inverse
Begins with in!
which sounds like IN!
which stands for not

⇒ Add the word not to make the inverse

If not 1 , then not 2

Converse ⇒ Change the order of 1 and 2

If 2 , then 1

Contrapositive ⇒ Do both inverse and converse

If not 2 , then not 1

If Corey not buy a new car, then Corey not work last summer

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]

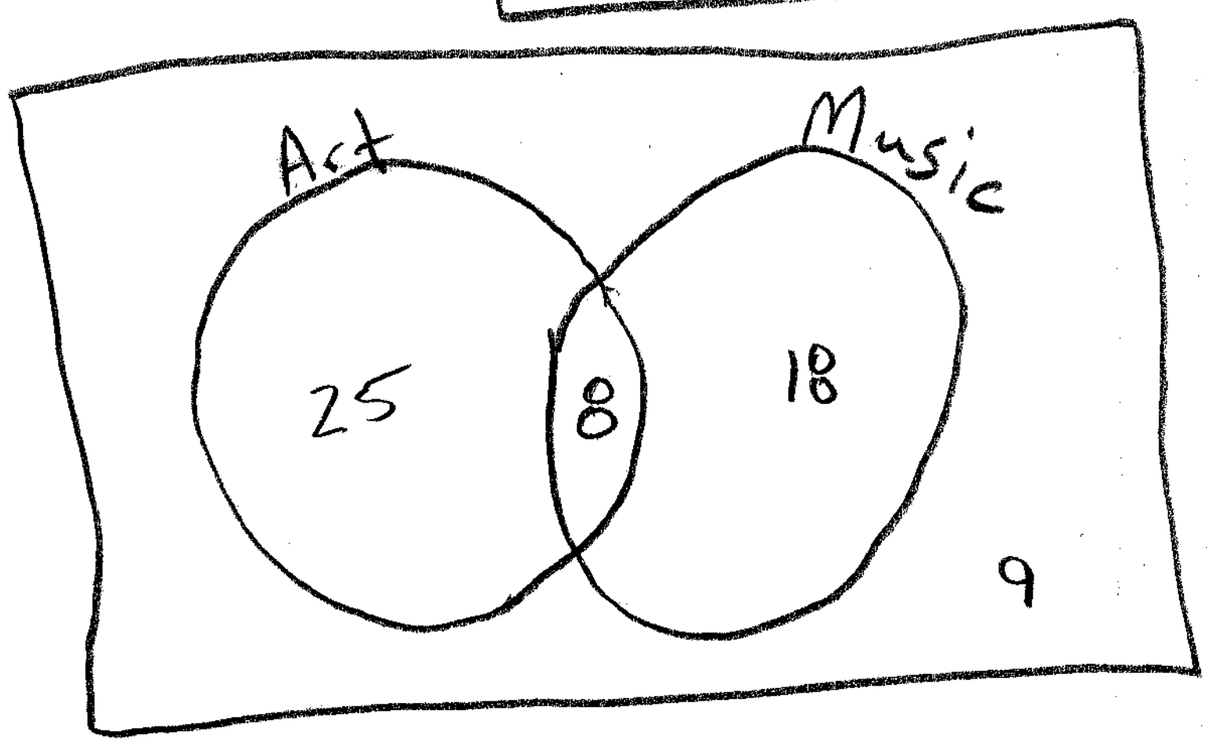
31 In Clark Middle School, there are 60 students in seventh grade. If 25 of these students take art only, 18 take music only, and 9 do not take either art or music, how many take both art and music?

Solution #1

	Music	Not Music	Total
Art	8	25	33
Not Art	18	9	27
Total	26	34	60

Answer: 8 take both art + music

Solution #2



60

$60 - (25+18+9)$

$60 - (52)$

8

Answer: 8 take both art + music

32 Running at a constant speed, Andrea covers 15 miles in $2\frac{1}{2}$ hours. At this speed, how many *minutes* will it take her to run 2 miles?

$\frac{\text{distance}}{\text{time}} \Rightarrow \frac{15 \text{ miles}}{2\frac{1}{2} \text{ hours}} \Rightarrow \frac{15 \text{ miles}}{150 \text{ minutes}}$

$\frac{15 \text{ miles}}{150 \text{ minutes}} = \frac{2 \text{ miles}}{x \text{ minutes}}$

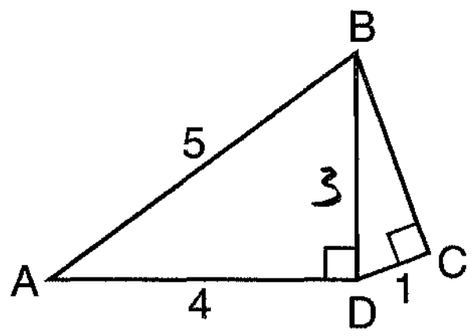
$\frac{15}{150} = \frac{2}{x}$

$15x = 300$

$x = 20$

20 minutes

33 In the accompanying diagram of right triangles ABD and DBC, $AB = 5$, $AD = 4$, and $CD = 1$. Find the length of $\overline{BC}$, to the *nearest tenth*.



Pythagorean Theorem

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

$(\overline{AD})^2 + (\overline{BD})^2 = (\overline{AB})^2$

$(4)^2 + (\overline{BD})^2 = (5)^2$

$16 + (\overline{BD})^2 = 25$

$-16 \qquad -16$

$(\overline{BD})^2 = 9$

$(\overline{BD}) = 3$

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

$(\overline{DC})^2 + (\overline{BC})^2 = (\overline{BD})^2$

$(1)^2 + (\overline{BC})^2 = (3)^2$

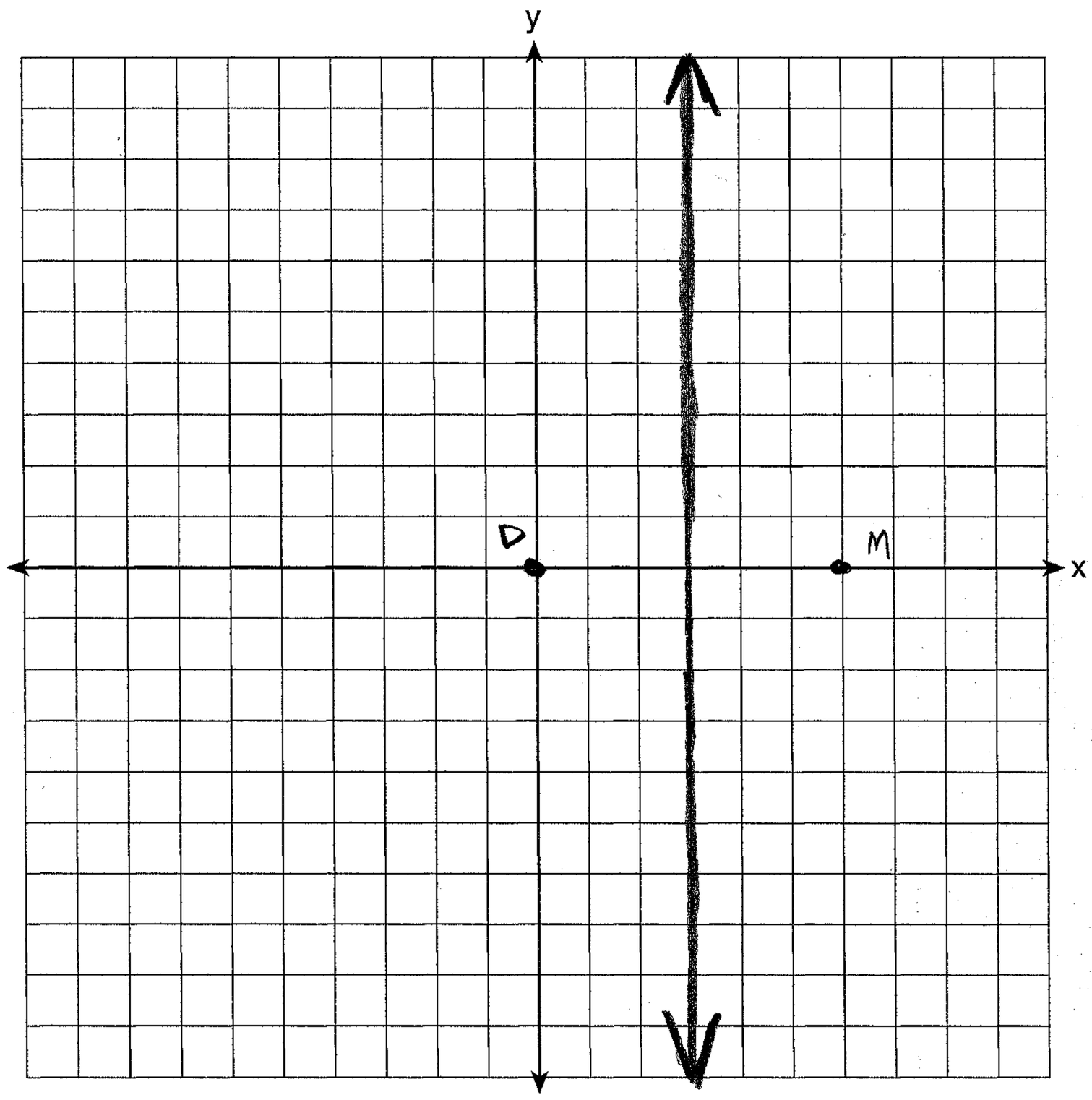
$1 + (\overline{BC})^2 = 9$

$(\overline{BC})^2 = 8$

$\overline{BC} = \sqrt{8}$

$\overline{BC} \approx 2.8$

34 Dan is sketching a map of the location of his house and his friend Matthew's house on a set of coordinate axes. Dan locates his house at point $D(0,0)$ and locates Matthew's house, which is 6 miles east of Dan's house, at point $M(6,0)$. On the accompanying set of coordinate axes, graph the locus of points equidistant from the two houses. Then write the equation of the locus.



The equation of the locus of points equidistant from points D and M is

$X = 3$

35 A recent survey shows that the average man will spend 141,288 hours sleeping, 85,725 hours working, 81,681 hours watching television, 9,945 hours commuting, 1,662 hours kissing, and 363,447 hours on other tasks during his lifetime. What percent of his life, to the *nearest tenth of a percent*, does he spend sleeping?

sleeping 141,288
working 85,725
television 81,681
commuting 9,945
kissing 1,662
other 363,447
TOTAL 683,748

$\frac{141,288}{683,748} = .2066375551$

20.6%

20.7%

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 Debbie goes to a diner famous for its express lunch menu. The menu has five appetizers, three soups, seven entrées, six vegetables, and four desserts. How many different meals consisting of either an appetizer *or* a soup, one entrée, one vegetable, and one dessert can Debbie order?

Appetizer or Soup Choices 5+3

Entrée Choices 7

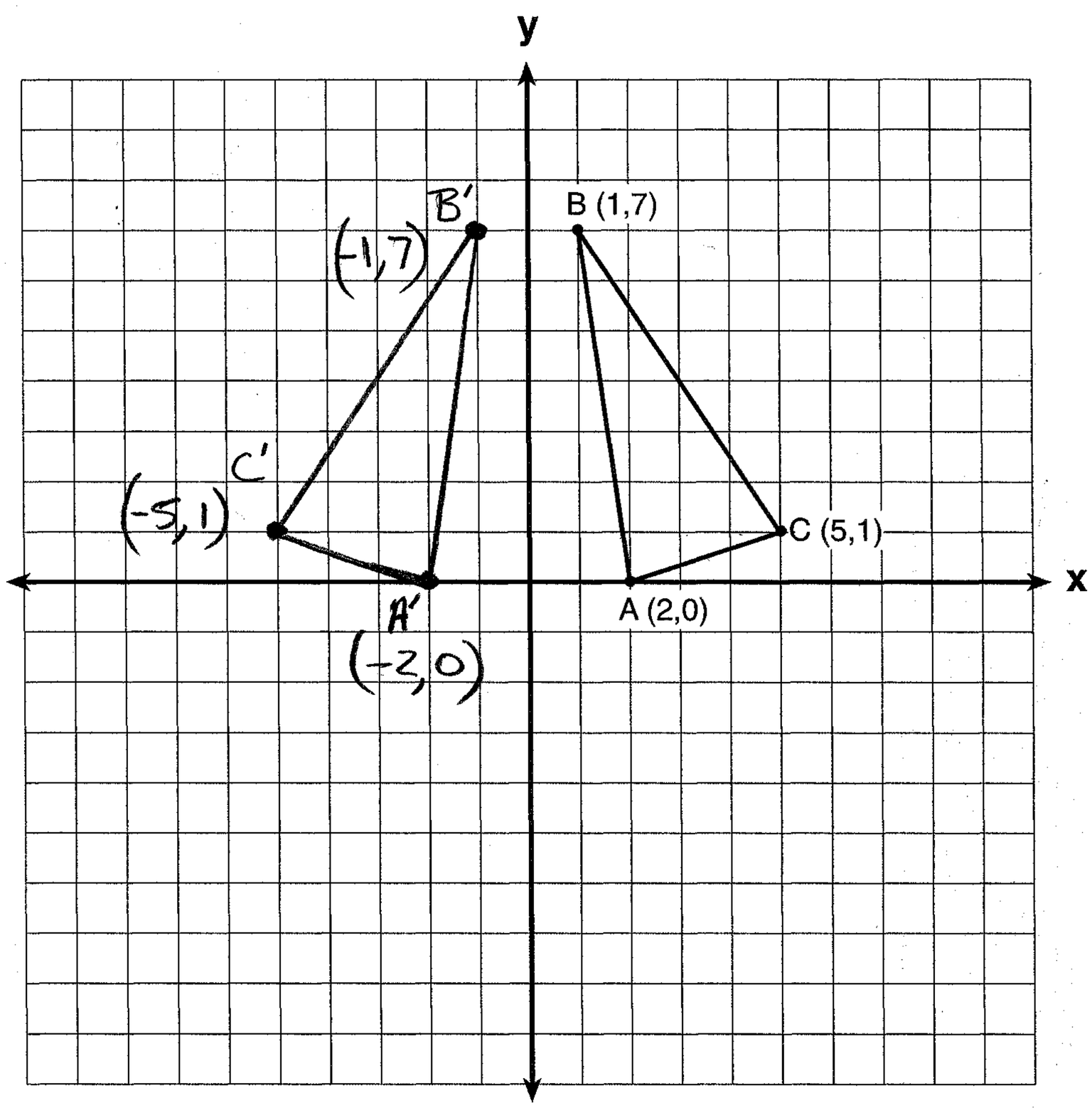
Veggie Choices 6

Dessert Choices 4

8 × 7 × 6 × 4 = 1,344

Debbie has 1,344 choices

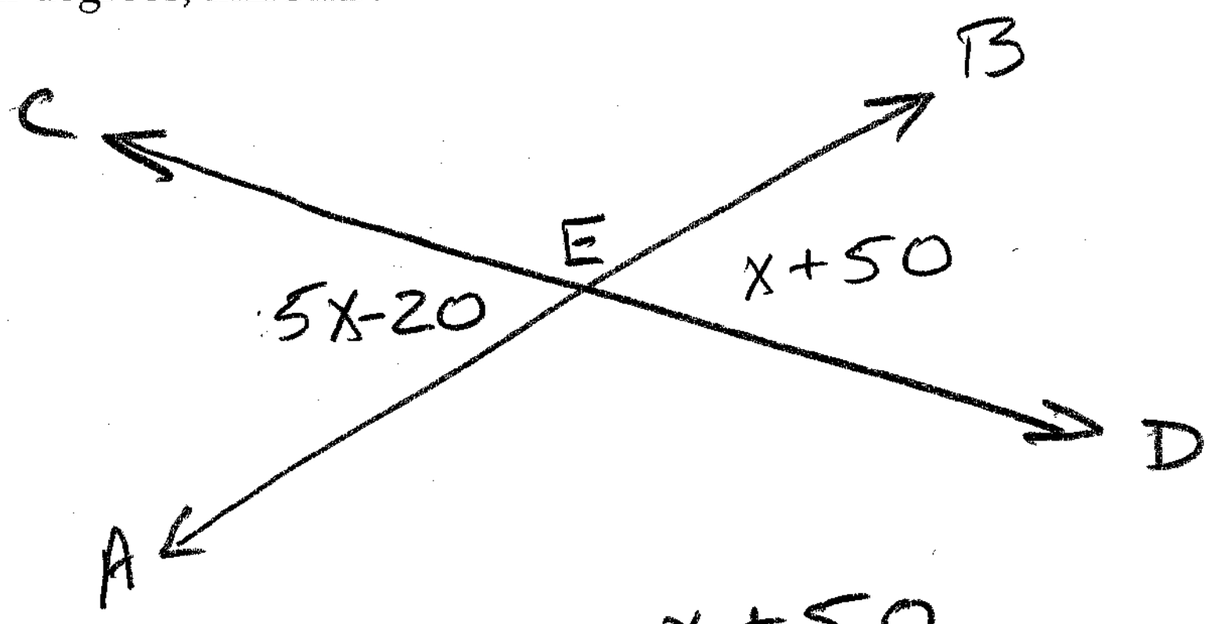
37 Triangle ABC has coordinates $A(2,0)$, $B(1,7)$, and $C(5,1)$. On the accompanying set of axes, graph, label, and state the coordinates of $\Delta A'B'C'$, the reflection of ΔABC in the y-axis.



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 $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ intersect at E. If m$\angle AEC = 5x - 20$ and m$\angle BED = x + 50$, find, in degrees, m$\angle CEB$.



$5x - 20 = x + 50$

$+20 \quad +20$

$5x = x + 70$

$-x \quad -x$

$4x = 70$

$x = 17.5$

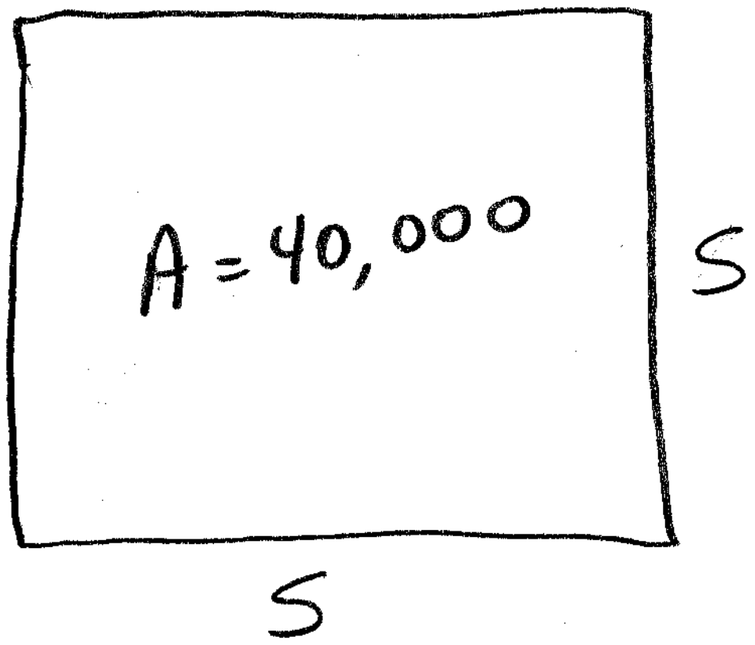
$m\angle AEC = 67.5°$

$m\angle BED = 67.5$

$m\angle CEB = 180° - 67.5°$

$m\angle CEB = 112.5°$

39 Manuel plans to install a fence around the perimeter of his yard. His yard is shaped like a square and has an area of 40,000 square feet. The company that he hires charges $2.50 per foot for the fencing and $50.00 for the installation fee. What will be the cost of the fence, in dollars?



$s^2 = 40{,}000$

$s = \sqrt{40{,}000}$

$s = 200 \Rightarrow$ Each side is 200 ft.

$P = 4s$

$P = 4(200)$

$P = 800 \Rightarrow$ The perimeter of the yard is 800 ft.

$2.50 (800) = cost of fence

$2000 = cost of fence

+50 installation fee

$2,050 = Total Cost

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

MATHEMATICS A

Wednesday, August 16, 2006 — 8:30 to 11:30 a.m., only

ANSWER SHEET

Student Imaginary Student Sex: ☐ Male ☐ Female Grade .....

Teacher Mr. Steve School IHS @ PH

Your answers to Part I should be recorded on this answer sheet.

Part I

Answer all 30 questions in this part.

1	1	9	4	17	2	25	2
2	3	10	2	18	3	26	2
3	3	11	1	19	1	27	4
4	2	12	4	20	4	28	1
5	3	13	4	21	4	29	1
6	2	14	3	22	3	30	2
7	1	15	4	23	3		
8	1	16	4	24	1		

Your answers for Parts II, III, and IV should be written in the test booklet.

The declaration below should be signed when you have completed the examination.

I do hereby affirm, at the close of this examination, that I had no unlawful knowledge of the questions or answers prior to the examination and that I have neither given nor received assistance in answering any of the questions during the examination.

RDW

Signature

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