The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

MATHEMATICS A

Tuesday, August 16, 2005 — 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. 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 The weights of all the students in grade 9 are arranged from least to greatest. Which statistical measure separates the top half of this set of data from the bottom half?

(1) mean   (3) median
(2) mode   (4) average

2 Cole's Ice Cream Stand serves sixteen different flavors of ice cream, three types of syrup, and seven types of sprinkles. If an ice cream sundae consists of one flavor of ice cream, one type of syrup, and one type of sprinkles, how many different ice cream sundaes can Cole serve?

(1) 10,836   (3) 3
(2) 336   (4) 26

Handwritten: Flavor Choices, Syrup Choices, Sprinkles Choices

$$16 \times 3 \times 7 = 336$$

3 The value of $\frac{7!}{3!}$ is

(1) 840   (3) 7
(2) 24   (4) 4

$$\frac{7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{3 \cdot 2 \cdot 1} = \frac{840}{1} = 840$$

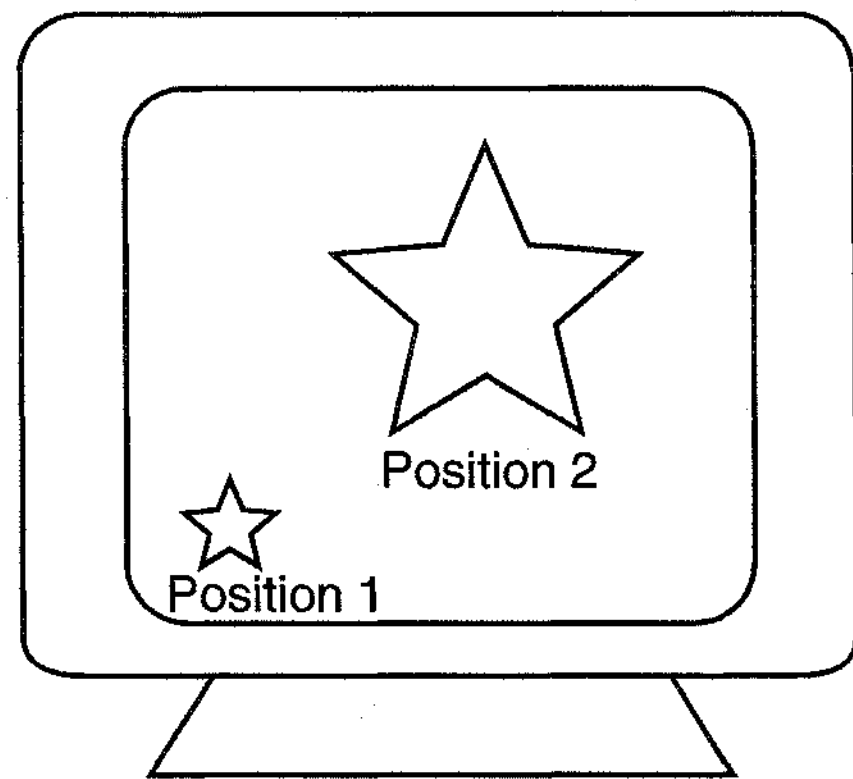4 The equation $*(\Delta + \heartsuit) = *\Delta + *\heartsuit$ is an example of the

(1) associative law   (3) distributive law
(2) commutative law   (4) transitive law

5 The statement "x is divisible by 5 or x is divisible by 4" is *false* when x equals

(1) 10   (3) 20
(2) 16   (4) 27

6 As shown in the accompanying diagram, the star in position 1 on a computer screen transforms to the star in position 2.

This transformation is best described as a

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

Dilation
Makes an image bigger or smaller, like the pupils of the eye get bigger or smaller when they dilate.

7 A stop sign in the shape of a regular octagon is resting on a brick wall, as shown in the accompanying diagram.

STOP

∠x is an exterior ∠
The sum of all exterior ∠s is always 360°
There are 8 ∠s in an octagon
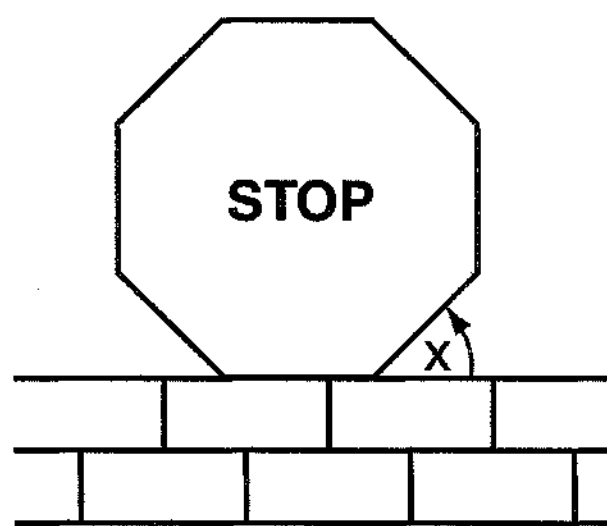
$$\frac{360°}{8} = 45°$$

What is the measure of angle x?

(1) 45°   (3) 120°
(2) 60°   (4) 135°

8 The height of a golf ball hit into the air is modeled by the equation $h = -16t^2 + 48t$, where h represents the height, in feet, and t represents the number of seconds that have passed since the ball was hit. What is the height of the ball after 2 seconds?

(1) 16 ft   (3) 64 ft
(2) 32 ft   (4) 80 ft

$h = -16t^2 + 48t$
$t = 2$
$h = -16(2)^2 + 48(2)$
$h = -16(4) + 96$
$h = -64 + 96$
$h = 32$

9 The sum of Scott's age and Greg's age is 33 years. If Greg's age is represented by g, Scott's age is represented by

(1) $33 - g$
(2) $g - 33$
(3) $g + 33$
(4) $33g$

$S + G = 33$
$\underline{ -G \qquad -G}$
$S \qquad = 33 - G$

10 The accompanying diagram shows two parallel streets, Main Street and Brooks Road, intersected by Jay Street. The obtuse angle that Jay Street forms with Brooks Road is three times the measure of the acute angle that Jay Street forms with Main Street.

Main Street

x Jay Street

3X

Brooks Road
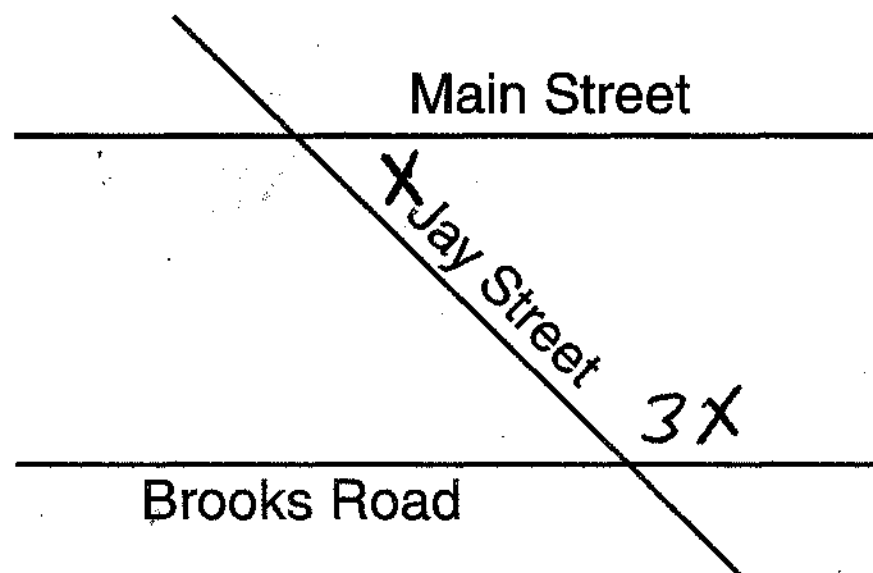
$X + 3X = 180°$
$4X = 180°$
$X = 45°$

What is the measure of the acute angle formed by Jay Street and Main Street?

(1) $45°$
(2) $60°$
(3) $90°$
(4) $135°$
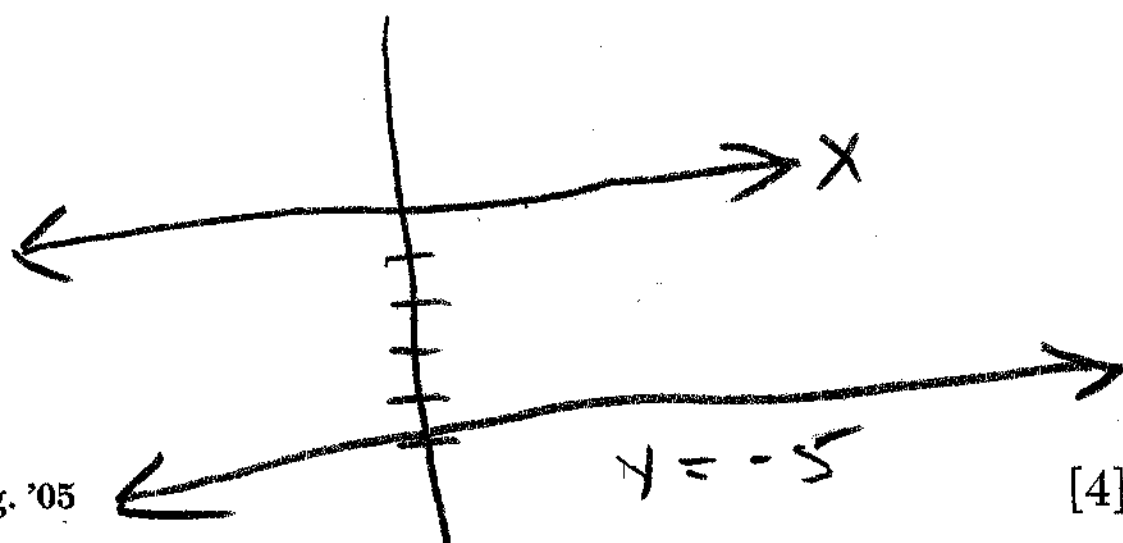
11 The expression 0.62×10^3 is equivalent to

(1) 0.062
(2) $62,000$
(3) 6.2×10^4
(4) 6.2×10^2

$6.2 \times 10^{3-1}$

6.2×10^2

Moving the decimal right is negative
left is positive

12 Which equation represents the locus of all points 5 units below the x-axis?

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

X

$y = -5$

[4]

13 Which ordered pair is *not* in the solution set of $y > 2x + 1$?

(1) (1,4) $4 > 2(1) + 1$ (3) (3,8) $8 > 2(3) + 1$

(2) (1,6) $6 > 2(1) + 1$ (4) (2,5) $5 \not> 2(2) + 1$

Use this space for computations.

14 What is the identity element for ♣ in the accompanying table?
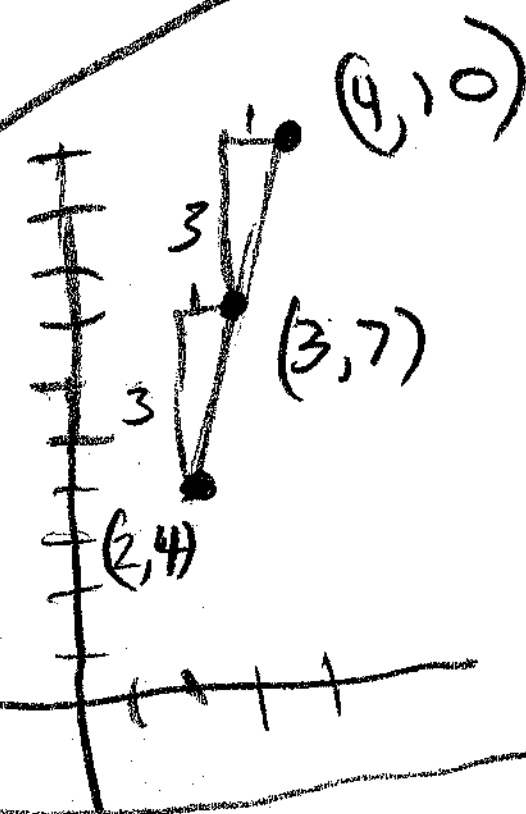
♣	r	s	t	u
r	t	r	u	s
s	r	s	t	u
t	u	t	s	r
u	s	u	r	t

(1) r   (3) t

(2) s   (4) u

The identity element under an operation preserves the identity of the other elements.

(9,10)

3

(3,7)

3

(2,4)

Graphing Solution

15 A line segment on the coordinate plane has endpoints (2,4) and (4,y). The midpoint of the segment is point (3,7). What is the value of y?

(1) 11   (3) 5

(2) 10   (4) –2

MP Formula Solution

$$\left(X_{mp}, Y_{mp}\right) = \left(\frac{X_1 + X_2}{2}, \frac{Y_1 + Y_2}{2}\right) \Rightarrow Y_{mp} = \frac{Y_1 + Y_2}{2} \Rightarrow 7 = \frac{4+y}{2} \Rightarrow 14 = 4+y \Rightarrow 10 = y$$

16 Which numbers are arranged from <u>smallest to largest</u>?

(1) $3.14, \frac{22}{7}, \pi, \sqrt{9.1}$ (3) $\sqrt{9.1}, 3.14, \frac{22}{7}, \pi$

(2) $\sqrt{9.1}, \pi, 3.14, \frac{22}{7}$ (4) $\sqrt{9.1}, 3.14, \pi, \frac{22}{7}$

$3.14 \Rightarrow 3.1400$ *Next Smallest*

$\frac{22}{7} \Rightarrow 3.142857$ *Biggest*

$\pi \Rightarrow 3.14159...$ *Next Biggest*

$\sqrt{9.1} \Rightarrow 3.01662...$ *Smallest*

17 In a certain quadrilateral, two opposite sides are parallel, and the other two opposite sides are *not* congruent. This quadrilateral could be a

(1) rhombus   (3) square

(2) parallelogram   (4) trapezoid

Math. A – Aug. '05   [5]   [OVER]
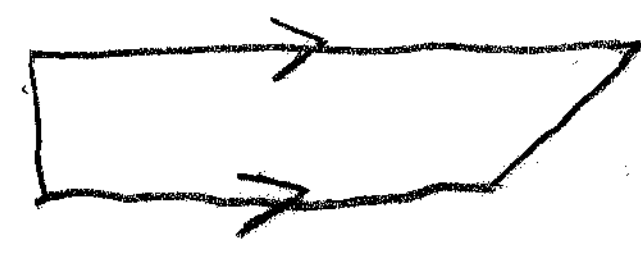
18 A bicyclist leaves Bay Shore traveling at an average speed of 12 miles per hour. Three hours later, a car leaves Bay Shore, on the same route, traveling at an average speed of 30 miles per hour. How many hours after the car leaves Bay Shore will the car catch up to the cyclist?

(1) 8   (3) 5
(2) 2   (4) 4

Use this space for computations.

$$H(12) = (H-3)\,30$$
$$12H = 30H - 90$$
$$-12H \quad -12H$$
$$0 = 18H - 90$$

$H - 3 = 2$ ← Cars Hours

$$0 = 18H - 90$$
$$+90 \qquad +90$$
$$90 = 18H$$
$$5 = H$$
↑ Bicycle's Hours

19 Which letter demonstrates line symmetry but *not* point symmetry?

(1) **T**   (3) **H**
(2) **N**   (4) **S**

20 Sara is building a triangular pen for her pet rabbit. If two of the sides measure 8 feet and 15 feet, the length of the third side could be

(1) 13 ft   (3) 3 ft $8 + 3 \neq 15$
(2) 7 ft $7 + 8 \neq 15$ (4) 23 ft $8 + 15 \neq 23$

The sum of any 2 sides must be greater than the 3rd side.

21 What is the converse of the statement "If Alicia goes to Albany, then Ben goes to Buffalo"?

(1) If Alicia does not go to Albany, then Ben does not go to Buffalo.
(2) Alicia goes to Albany if and only if Ben goes to Buffalo.
(3) If Ben goes to Buffalo, then Alicia goes to Albany
(4) If Ben does not go to Buffalo, then Alicia does not go to Albany.

Given If 1, then 2
Inverse If not 1, then not 2
→ Converse If 2, then 1
Contrapositive If not 2, then not 1

If Ben goes to Buffalo, then Alicia goes to Albany.

22 What is the value of 2^{-3}?

(1) $\frac{1}{6}$ (3) -6
(2) $\frac{1}{8}$ (4) -8

$$2^{-3} = \frac{1}{2^3} = \frac{1}{2 \cdot 2 \cdot 2} = \frac{1}{8}$$

23 Which is an irrational number?

(1) $0.\overline{3}$ $= \frac{1}{3}$

(3) $\sqrt{49}$ $= \frac{7}{1}$

(2) $\frac{3}{8}$

(4) π

Rational #s can be expressed as ratios of integers.
Irrational #s cannot.

24 What is the sum of $5\sqrt{7}$ and $3\sqrt{28}$?

(1) $9\sqrt{7}$

(3) $60\sqrt{7}$

(2) $11\sqrt{7}$

(4) $8\sqrt{35}$

$5\sqrt{7} + 3\sqrt{28}$

$5\sqrt{7} + 3\sqrt{4}\sqrt{7}$

$5\sqrt{7} + 3(2)\sqrt{7}$

$5\sqrt{7} + 6\sqrt{7}$

$11\sqrt{7}$

25 The solution set for the equation $x^2 - 5x = 6$ is

(1) $\{1,-6\}$

(3) $\{-1,6\}$

(2) $\{2,-3\}$

(4) $\{-2,3\}$

One factor is neg.
and one is pos.

$x^2 - 5x = 6$

$\underline{\quad -6 \quad -6}$

$x^2 - 5x - 6 = 0$

$(x+\_)(x-\_) = 0$

Factors of 6 are
6+1 and 2+3

$(x+1)(x-6) = 0$

$x+1 = 0 \quad x-6 = 0$

$x = -1 \quad x = 6$

26 The expression $\frac{5x^6y^2}{x^8y}$ is equivalent to

(1) $5x^2y$

(3) $5x^{14}y^3$

(2) $\frac{5y}{x^2}$

(4) $\frac{5y^3}{x^{14}}$

5	x^6	y^2
1	x^8	y
$\frac{5}{1}$	x^{6-8}	y^{2-1}
5	x^{-2}	y

$\Rightarrow \left(\frac{5}{1}\right)\left(\frac{1}{x^2}\right)\frac{y}{1} \Rightarrow \frac{5y}{x^2}$

27 The expression $_9C_2$ is equivalent to

(1) $_9P_2$

(3) $_9C_7$

(2) $_9P_7$

(4) $\frac{9!}{2!}$

$_9C_2 = \frac{\boxed{9}\;\boxed{8}}{\boxed{2}\;\boxed{1}} = \frac{72}{2} = 36$

$_9C_7 = \frac{\boxed{9}\cdot\boxed{8}\;\boxed{7}\;\boxed{6}\;\boxed{5}\;\boxed{4}\;\boxed{3}}{\boxed{7}\;\boxed{6}\;\boxed{5}\;\boxed{4}\;\boxed{3}\;\boxed{2}\;\boxed{1}} = \frac{72}{2} = 36$

28 The graph of the equation $x^2 + y^2 = 4$ can be described as a

~~(1) line passing through points (0,2) and (2,0)~~
~~(2) parabola with its vertex at (0,2)~~
(3) circle with its center at the origin and a radius of 2
(4) circle with its center at the origin and a radius of 4

29 When solved graphically, which system of equations will have *exactly* one point of intersection?

(1) $y = -x - 20$
$\quad y = x + 17$

(3) $y = \frac{3}{5}x + 12$
$\quad y = 0.6x - 19$ } same slope ∴ parallel — no points of intersection

(2) $y = 0.5x + 30$
$\quad y = 0.5x - 30$ } → same slope

(4) $y = -x + 15$
$\quad y = -x + 25$ } same slope

30 If $\frac{x}{4} - \frac{a}{b} = 0$, $b \neq 0$, then x is equal to

(1) $-\frac{a}{4b}$

(3) $-\frac{4a}{b}$

(2) $\frac{a}{4b}$

(4) $\frac{4a}{b}$

$$\frac{x}{4} - \frac{a}{b} = 0$$
$$+ \frac{a}{b} \qquad + \frac{a}{b}$$

$$\frac{x}{4} = \frac{a}{b}$$

cross multiply

Divide (b)

$$x(b) = 4(a)$$

$$\frac{xb}{b} = \frac{4a}{b}$$

$$x = \frac{4a}{b}$$

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 The accompanying diagram shows a kite that has been secured to a stake in the ground with a 20-foot string. The kite is located 12 feet from the ground, directly over point X. What is the distance, in feet, between the stake and point X?

Kite

c

20 ft

12 ft b

Stake X

a
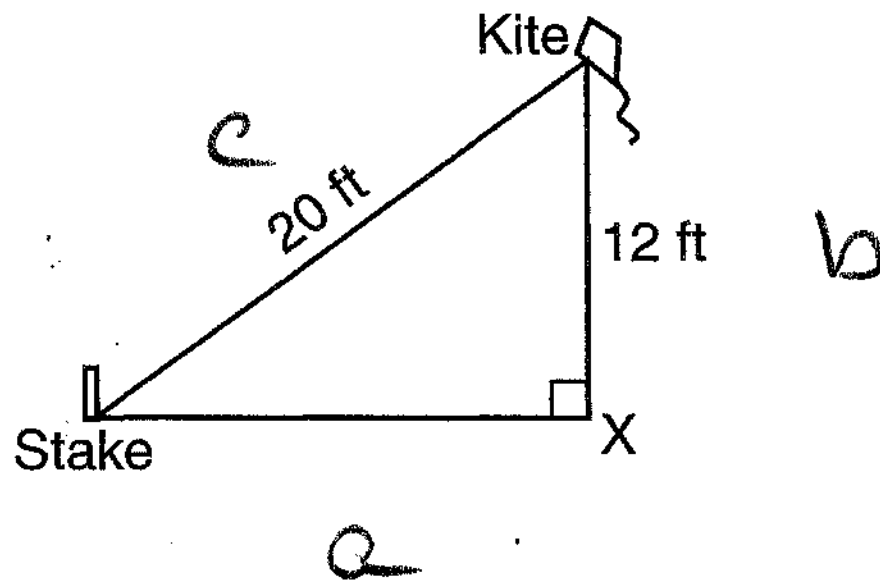
$$Pythagorean\ Theorem$$

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

$$a^2 + (12)^2 = (20)^2$$

$$a^2 + 144 = 400$$

$$-144 \quad -144$$

$$a^2 = 256$$

$$\sqrt{a^2} = \sqrt{256}$$

$$a = \boxed{16\ feet}$$

32 There are 30 students on a school bus. Of these students, 24 either play in the school band or sing in the chorus. Six of the students play in the school band but do not sing in the chorus. Fourteen of the students sing in the chorus and also play in the school band. How many students on the school bus sing in the chorus but do *not* play in the band?

⟹ 6 do neither

Solution #1

	Band	Not Band	Total
Chorus	14	4	18
Not Chorus	6	6	12
Total	20	10	30

Solution #2

Band 6 (14) 4 Chorus

6
30
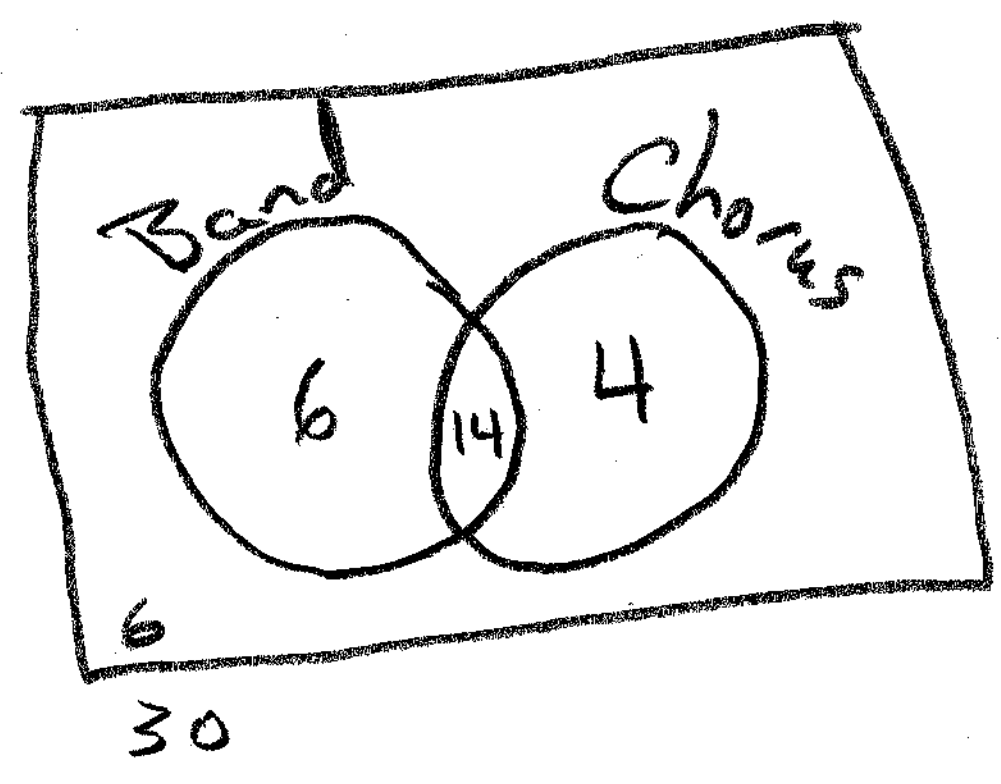
**4** Students sing in the chorus, but do play in the band

33 Factor completely: $5n^2 - 80$

$$5n^2 - 80$$
$$(5)(n^2 - 16)$$
$$(5)(n+4)(n-4)$$

34 Nine hundred students were asked whether they thought their school should have a dress code. A circle graph was constructed to show the results. The central angles for two of the three sectors are shown in the accompanying diagram. What is the number of students who felt that the school should have *no* dress code?

Partial dress code

Full dress code

25°

95°

240°
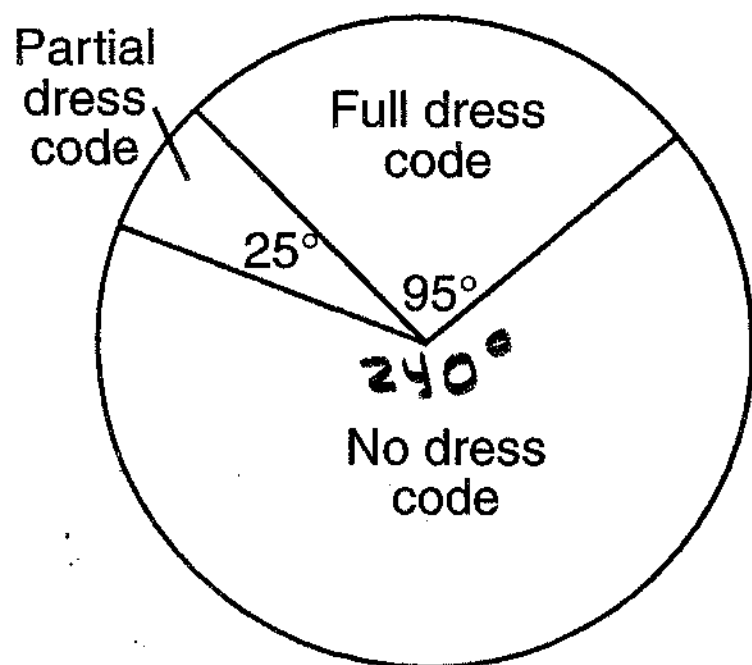
No dress code

$$360° - (25° + 95°)$$

$$360° - (120°)$$

$$240°$$

$$\frac{Part}{Whole} : \quad \frac{240°}{360°} = \frac{X}{900}$$

$$240(900) = 360X$$

$$216,000 = 360X$$

$$600 = X$$

Answer
600 students do not want a dress code

---

35 Seth bought a used car that had been driven 20,000 miles. After he owned the car for 2 years, the total mileage of the car was 49,400. Find the average number of miles he drove *each month* during those 2 years.

$$\begin{array}{r} 49,400 \\ -20,000 \\ \hline 29,400 \end{array}$$ → This is how much Seth drove the car in miles

$$2 \times 12 = 24$$ → This is the # of months Seth drove the car

$$\frac{29,400}{24} = 1225$$

Seth drove the car an average of $\boxed{1225 \text{ miles/month}}$

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 A tree casts a shadow that is 20 feet long. The angle of elevation from the end of the shadow to the top of the tree is 66°. Determine the height of the tree, to the *nearest foot*.
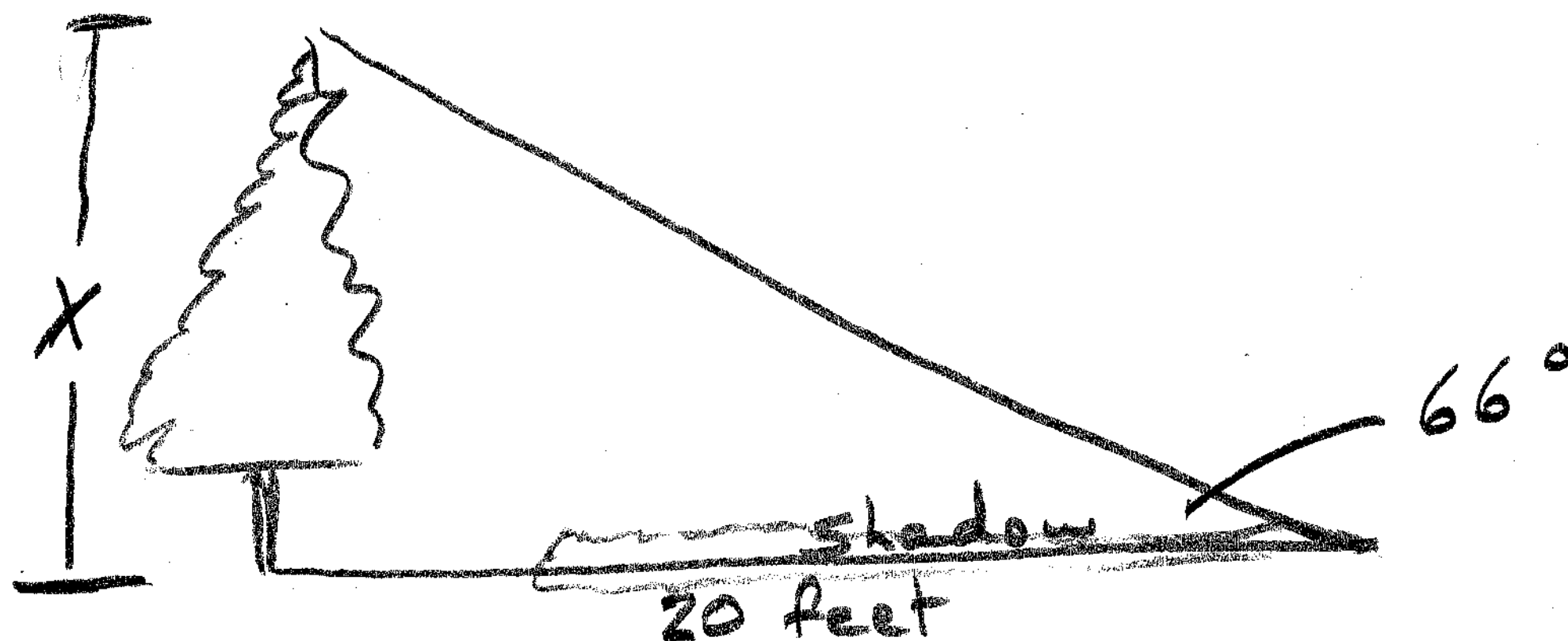
$$SOH \cdot CAH - TOA$$

$$S = \frac{O}{H} \quad C = \frac{A}{H} \quad \boxed{T = \frac{O}{A}}$$

$$\text{Tan } 66° = \frac{x}{20}$$

Put Calculator in Degree Mode

$$2.246036774 = \frac{x}{20}$$

$$44.92073548 = x$$

The tree is approximately $\boxed{45 \text{ feet tall}}$

37 In the accompanying diagram, the perimeter of $\triangle MNO$ is equal to the perimeter of square $ABCD$. If the sides of the triangle are represented by $4x + 4$, $5x - 3$, and 17, and one side of the square is represented by $3x$, find the length of a side of the square.

M, 4x + 4, N, 17, 5x − 3, O

A, B, 3x, D, C
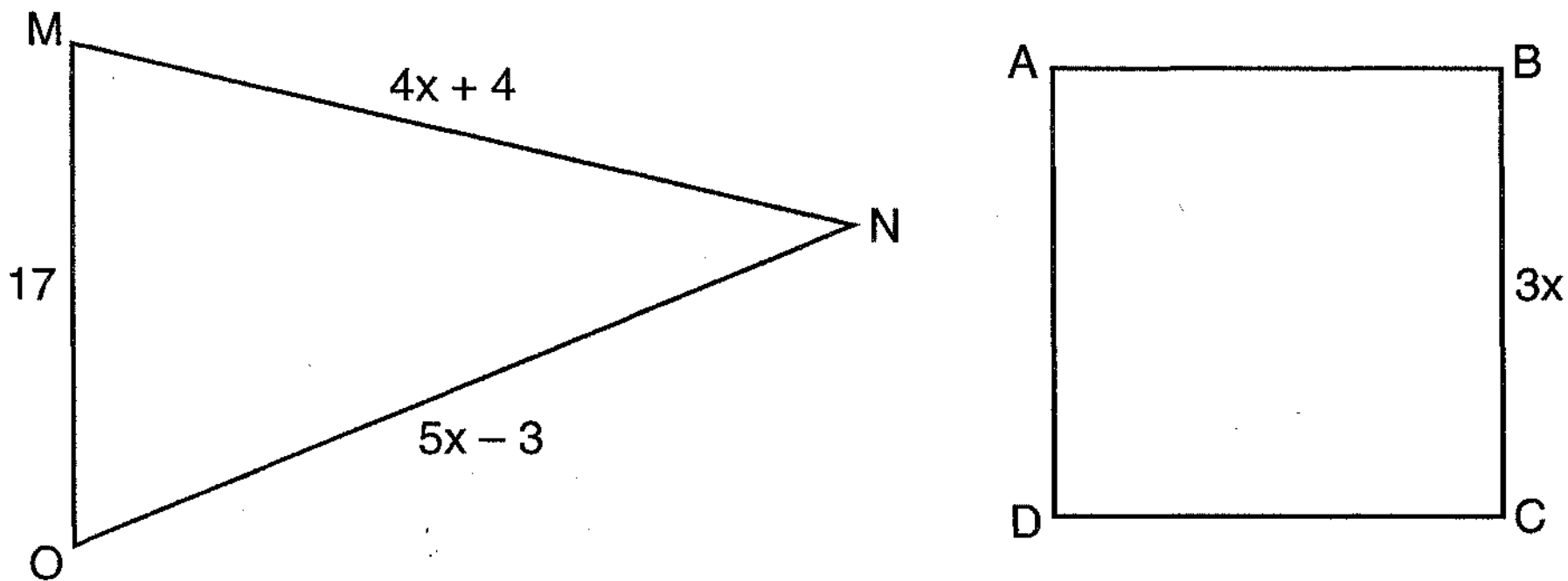
$$P_\triangle = 17 + (4x+4) + (5x-3) \Rightarrow 9x + 18$$

$$P_\square = (3x) + (3x) + (3x) + (3x) \Rightarrow 12x$$

$$P_\triangle = P_\square$$

$$9x + 18 = 12x$$
$$-9x \qquad\qquad -9x$$
$$\overline{\qquad\qquad\qquad}$$
$$18 = 3x$$
$$6 = x$$

A side of the square is 3X, so each side is $3(6) \Rightarrow \boxed{18}$

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 Solve the following system of equations:

$$y = x^2 + 4x + 1$$
$$y = 5x + 3$$

[The use of the grid on the next page is optional.]

$$y = X^2 + 4X + 1$$

$$y = 5X + 3$$

Checks

$(-1, -2)$

$-2 = -1^2 + 4(-1) + 1$

$-2 = 1 - 4 + 1$ ✓

$-2 = -2$

$(2, 13)$

$13 = 2^2 + 4(2) + 1$

$13 = 4 + 8 + 1$ ✓

$13 = 13$

$$X^2 + 4X + 1 = 5X + 3$$
$$-5X - 3 \qquad -5X - 3$$

$$X^2 - X - 2 = 0$$

$$(X + \underline{})(X - \underline{}) = 0$$

$$(X + 1)(X - 2) = 0$$

$$X + 1 = 0 \qquad X - 2 = 0$$
$$X = -1 \qquad X = 2$$

Find Y-values

$$y = 5(-1) + 3 \qquad y = 5(2) + 3$$
$$y = -5 + 3 \qquad y = 10 + 3$$
$$y = -2 \qquad y = 13$$

$$(-1, -2) \qquad 2, 13$$

2 Solutions

$y = x^2 + 4x + 1$

$y = 5x + 3$

(2, 13)

(-1, -2)
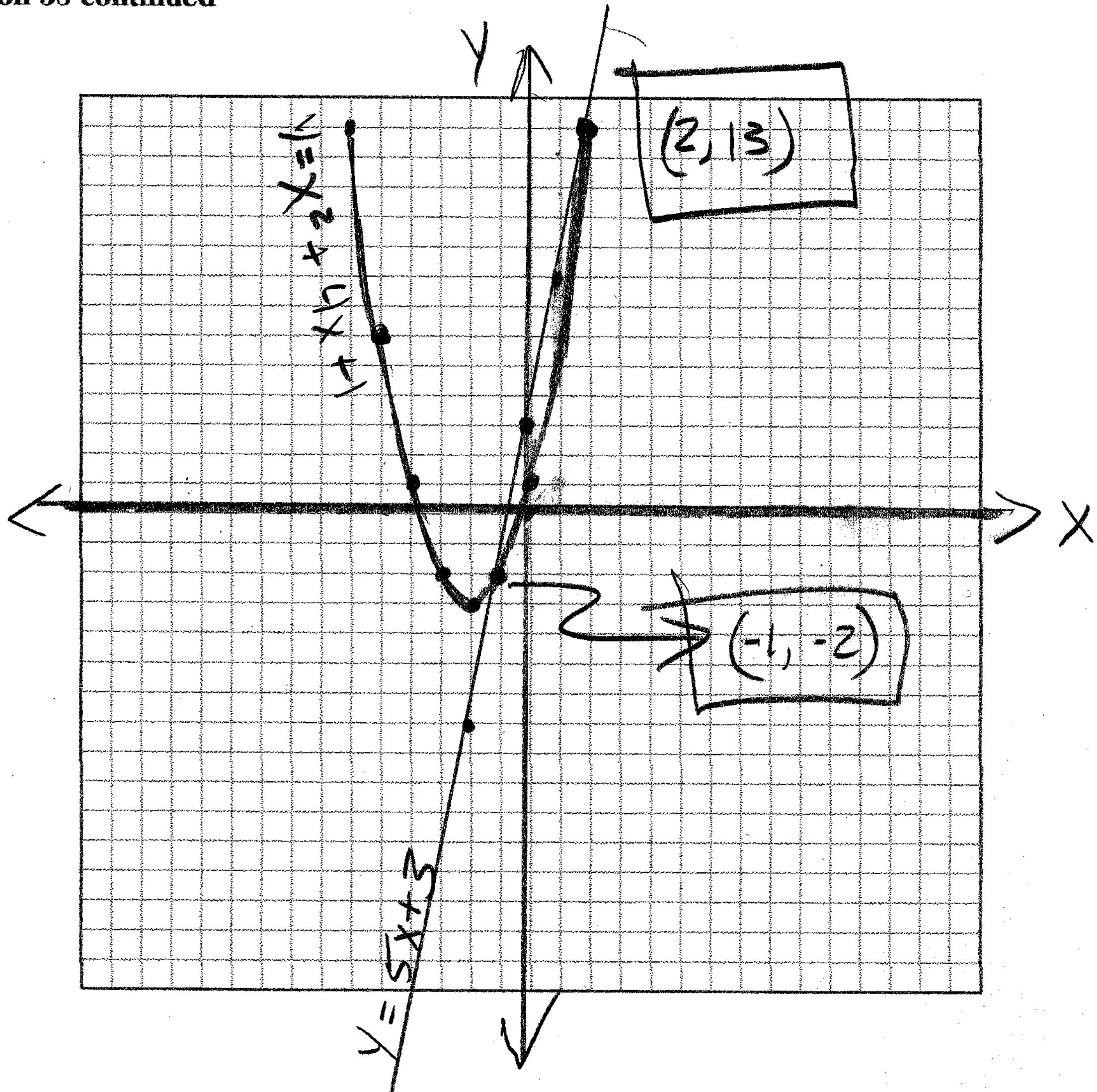
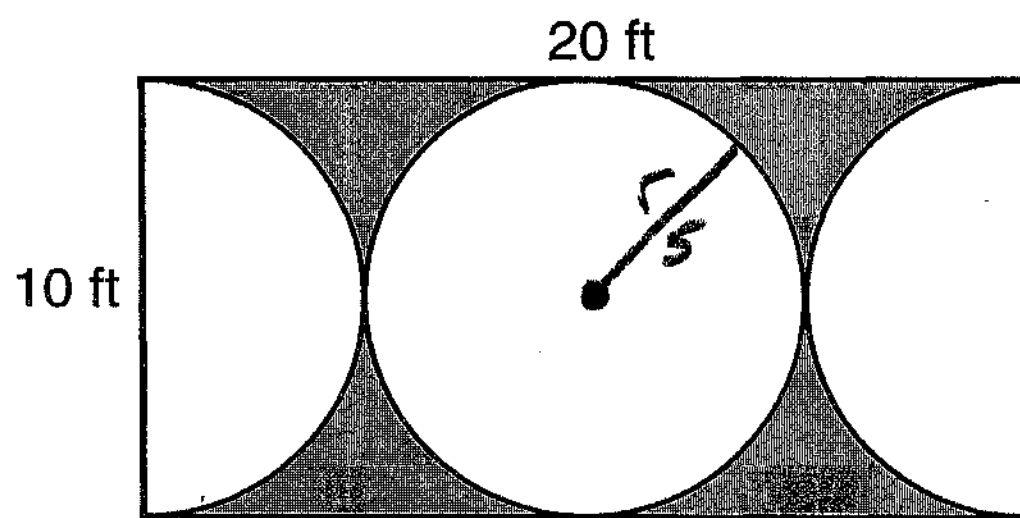**39** Mr. Petri has a rectangular plot of land with length = 20 feet and width = 10 feet. He wants to design a flower garden in the shape of a circle with two semicircles at each end of the center circle, as shown in the accompanying diagram. He will fill in the shaded area with wood chips. If one bag of wood chips covers 5 square feet, how many bags must he buy?

$$A_\square = \ell w$$

$$A_O = \pi r^2$$

$$A_\square = 20 \cdot 10 \Rightarrow 200 \; ft^2$$

$$A_O = \pi (5)^2 \Rightarrow 25\pi$$

There are two $\frac{1}{2}$ circles and one whole circle $\Rightarrow$ or 2 whole circles total, so the area of the circles is 50π

$$200 - 50\pi$$
$$200 - 157.08$$
$$42.92 \; ft^2$$

$$\frac{42.92 \; ft^2}{5 \; ft^2 \, per \, bag} = 8.58\ldots bags$$

Mr. Petri needs to buy 9 bags

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

MATHEMATICS A

Tuesday, August 16, 2005 — 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 ....3....	9 ....1....	17 ....4....	25 ....3....
2 ....2....	10 ....1....	18 ....2....	26 ....2....
3 ....1....	11 ....4....	19 ....1....	27 ....3....
4 ....3....	12 ....3....	20 ....1....	28 ....3....
5 ....4....	13 ....4....	21 ....3....	29 ....1....
6 ....4....	14 ....2....	22 ....2....	30 ....4....
7 ....1....	15 ....2....	23 ....4....	
8 ....2....	16 ....4....	24 ....2....	

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.

_____
Signature

Math. A – Aug. '05

[19]