The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

MATHEMATICS A

Monday, January 26, 2004 — 1:15 to 4:15 p.m., only

Print Your Name: Steve Watson

Print Your School's Name: IHS @ PH

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 your use while taking this examination.

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 If $2(x + 3) = x + 10$, then x equals

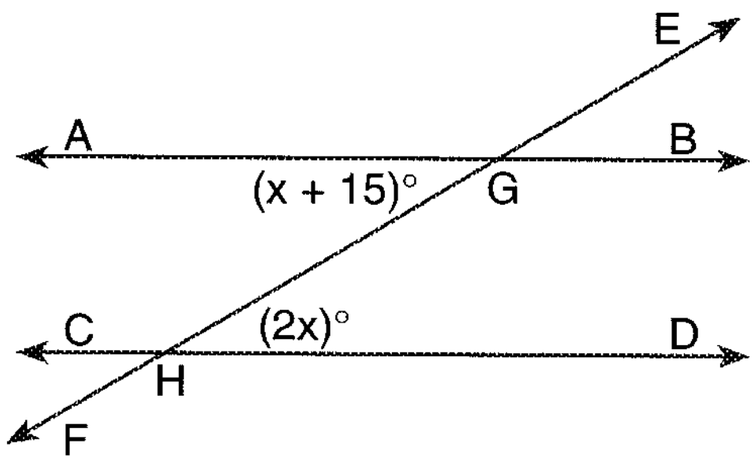
(1) 14
(2) 7
(3) 5
(4) 4

$2(x+3) = x+10$
$2x+6 = x+10$
$-x \quad -x$
$x+6 = 10$
$-6 \quad -6$
$x = 4$

Use this space for computations.

Check
$2(4+3) = 4+10$
$2(7) = 14$
$14 = 14$ ✓

2 In the accompanying diagram, parallel lines $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ are intersected by transversal $\overleftrightarrow{EF}$ at points G and H, respectively, $m\angle AGH = x + 15$, and $m\angle GHD = 2x$.



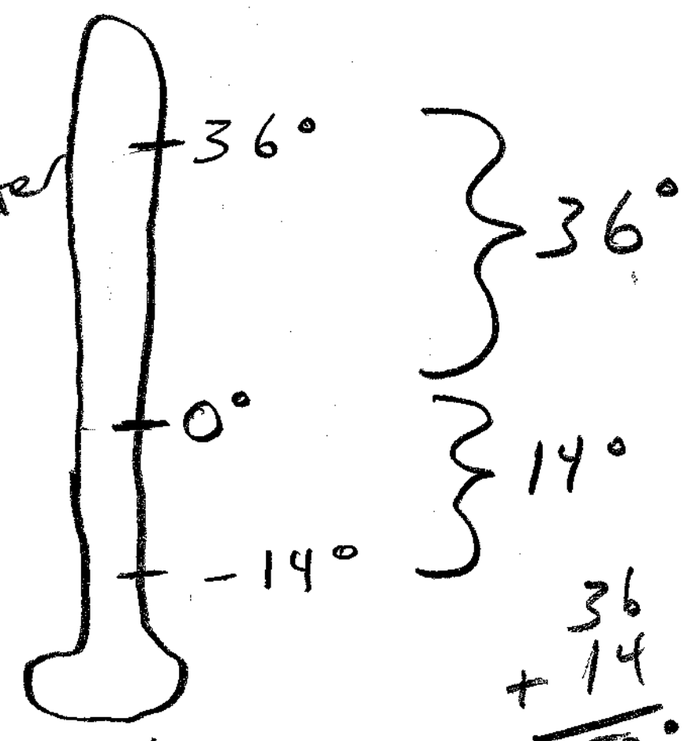
The measures of alternate interior ∠s are equal.
$x + 15 = 2x$
$-x \quad -x$
$15 = x$

Which equation can be used to find the value of x?

(1) $2x = x + 15$
(2) $2x + x + 15 = 180$
(3) $2x + x + 15 = 90$
(4) $2x(x + 15) = 0$

3 On February 18, from 9 a.m. until 2 p.m., the temperature rose from –14°F to 36°F. What was the total increase in temperature during this time period?

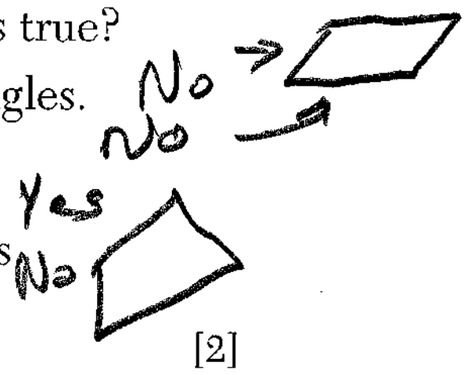
(1) 50°
(2) 36°
(3) 32°
(4) 22°



$36 + 14 = 50°$

4 Which statement about quadrilaterals is true?

(1) All quadrilaterals have four right angles.
(2) All quadrilaterals have equal sides.
(3) All quadrilaterals have four sides.
(4) All quadrilaterals are parallelograms.



5 In a school building, there are 10 doors that can be used to enter the building and 8 stairways to the second floor. How many different routes are there from outside the building to a class on the second floor?

(1) 1
(2) 10
(3) 18
(4) 80

Use this space for computations.

Door Choices × Stairway Choices
10 × 8 = 80

6 What is the value of $\frac{x^2 - 4y}{2}$, if $x = 4$ and $y = -3$?

(1) –2
(2) 2
(3) 10
(4) 14

$\frac{x^2 - 4y}{2}$
$\frac{(4)^2 - 4(-3)}{2}$
$\frac{16 + 12}{2}$
$\frac{28}{2}$
14

7 Given the true statements: "Jason goes shopping or he goes to the movies" and "Jason does not go to the movies."

Which statement must also be true?

(1) Jason stays home.
(2) Jason goes shopping.
(3) Jason does not go shopping.
(4) Jason does not go shopping and he does not go to the movies.

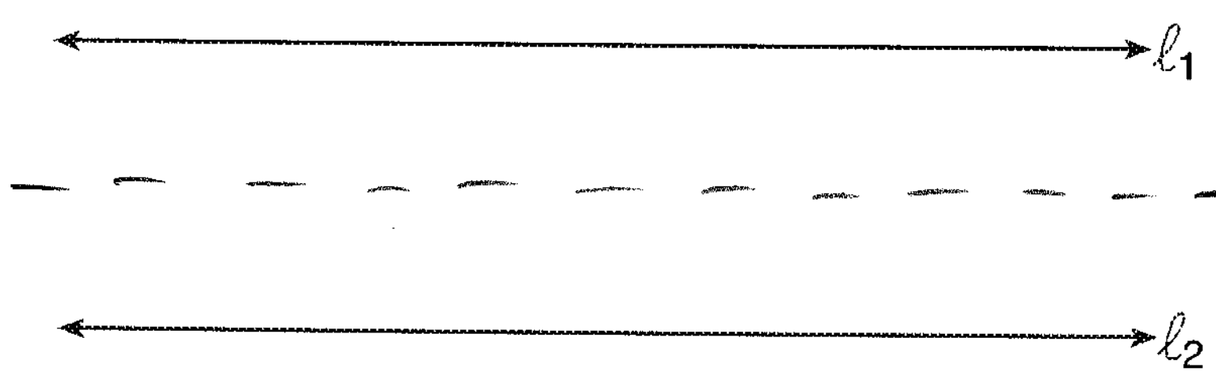
1 or 2
not 2
then 1

8 An equation of the line that has a slope of 3 and a y-intercept of –2 is

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

$y = mx + b$ (m: slope, b: y-intercept)
$y = 3x + (-2)$
$y = 3x - 2$

9 In the accompanying diagram, line ℓ_1 is parallel to line ℓ_2.



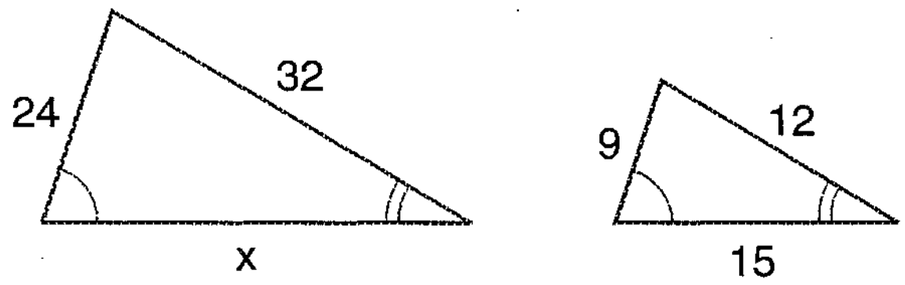
Which term describes the locus of all points that are equidistant from line ℓ_1 and line ℓ_2?

(1) line
(2) circle
(3) point
(4) rectangle

parallel to l_1 and l_2
All points on this line, halfway between l_1 and l_2, are equidistant from l_1 and l_2

10 The accompanying diagram shows two similar triangles.

Use this space for computations.



Which proportion could be used to solve for x?

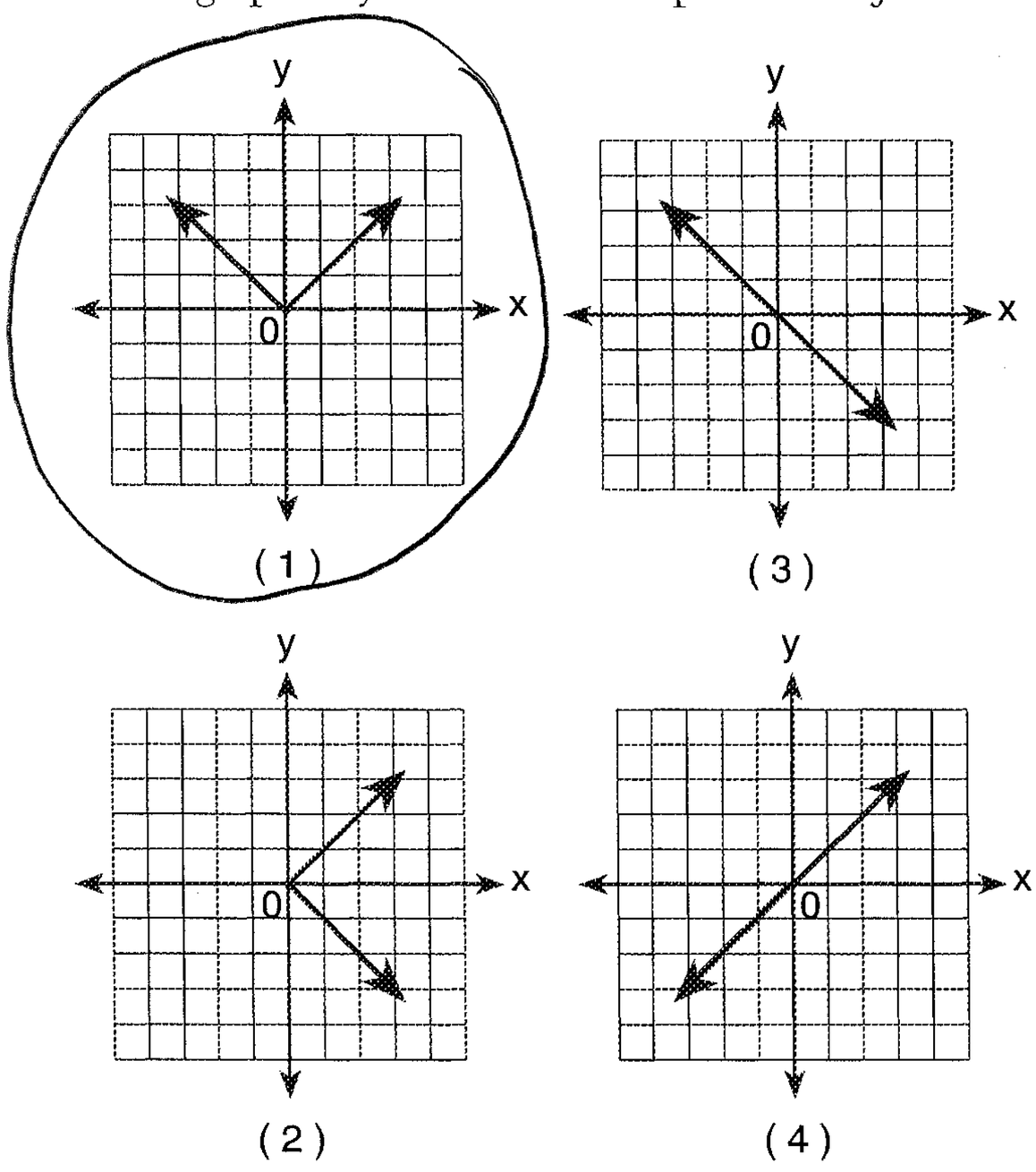
(1) $\frac{x}{24} = \frac{9}{15}$

(2) $\frac{24}{9} = \frac{15}{x}$

(3) $\frac{32}{x} = \frac{12}{15}$

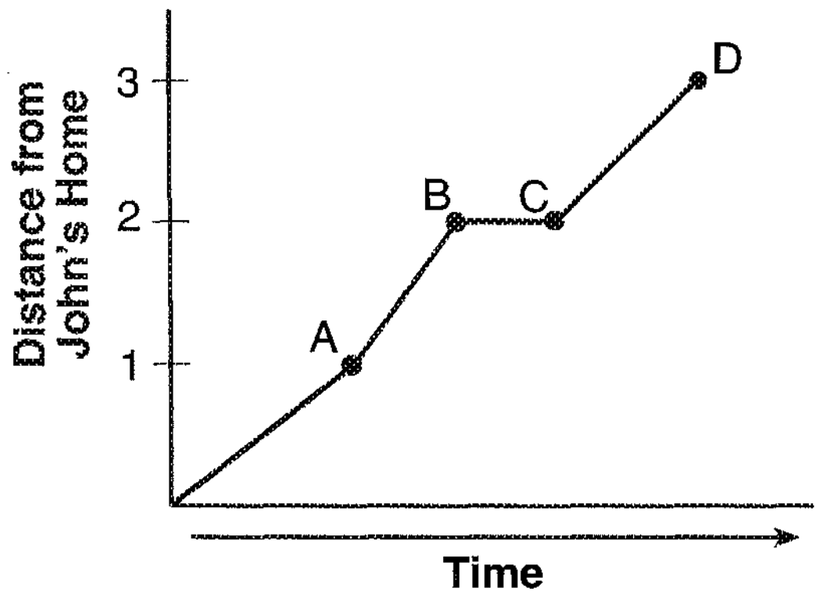
(4) $\frac{32}{12} = \frac{15}{x}$

11 Which graph is symmetric with respect to the y-axis?



12 John left his home and walked 3 blocks to his school, as shown in the accompanying graph.

Use this space for computations.



What is one possible interpretation of the section of the graph from point B to point C?

(1) John arrived at school and stayed throughout the day.
(2) John waited before crossing a busy street.
(3) John returned home to get his mathematics homework.
(4) John reached the top of a hill and began walking on level ground.

Between B and C

13 The expression $8^{-4} \bullet 8^{6}$ is equivalent to

(1) 8^{-24}
(2) 8^{-2}
(3) 8^{2}
(4) 8^{10}

$8^{-4} \cdot 8^{6} = 8^{-4+6} = 8^{2}$

14 What is a common factor of $x^2 - 9$ and $x^2 - 5x + 6$?

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

$x^2 - 9$
$(x+3)(x-3)$

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

1

15 Which statement is the converse of "If the sum of two angles is 180°, then the angles are supplementary"?

(1) If two angles are supplementary, then their sum is 180°.
(2) If the sum of two angles is not 180°, then the angles are not supplementary.
(3) If two angles are not supplementary, then their sum is not 180°.
(4) If the sum of two angles is not 180°, then the angles are supplementary.

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 the angles (2) are supplementary, then sum is 180 (1)

not a ratio of 2 integers

16 Which number is irrational?

(1) $\sqrt{9} = \frac{3}{1}$

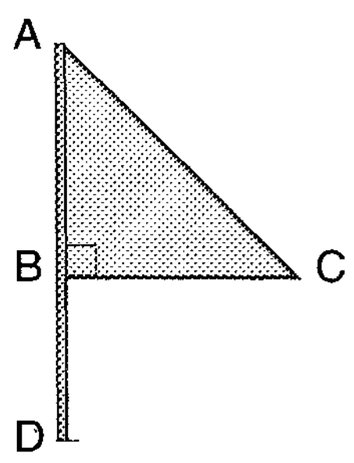
(2) $\sqrt{8}$

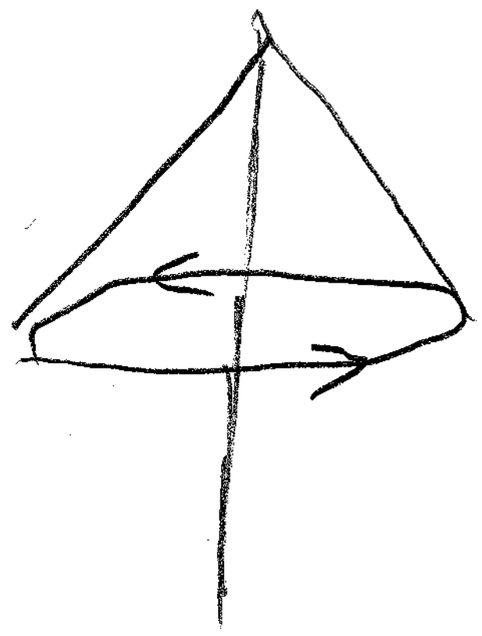
(3) $0.3333 = \frac{3333}{10000}$

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

Use this space for computations.

17 Triangle ABC represents a metal flag on pole AD, as shown in the accompanying diagram. On a windy day the triangle spins around the pole so fast that it looks like a three-dimensional shape.

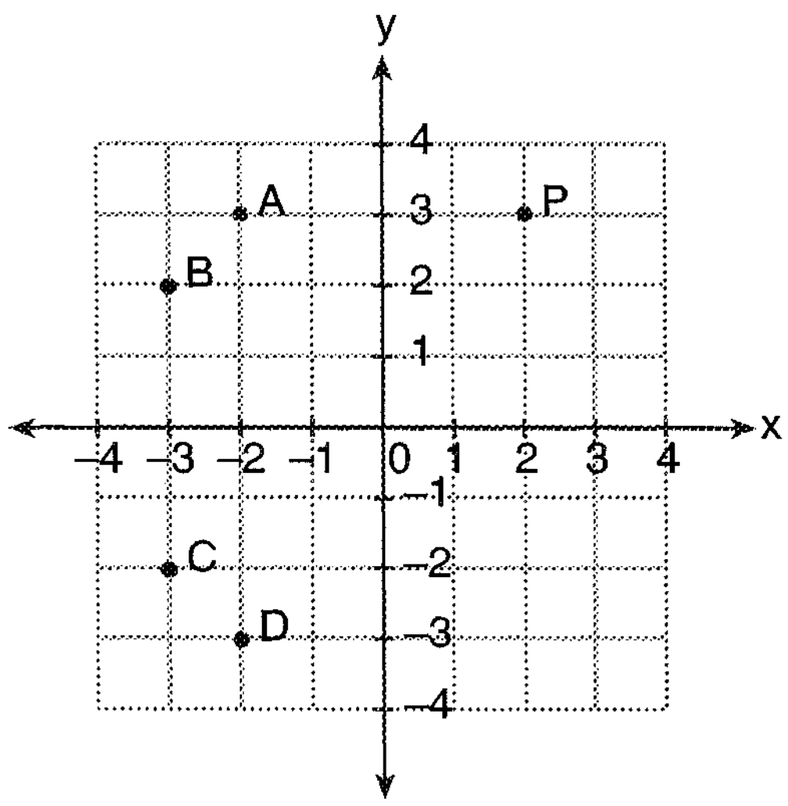




Which shape would the spinning flag create?

(1) sphere
(2) pyramid
(3) right circular cylinder
(4) cone

18 In the accompanying graph, if point P has coordinates (a,b), which point has coordinates $(-b,a)$?



P = (2, 3)

a = 2 b = 3

−b, a

(−3; 2) = point B

(1) A
(2) B
(3) C
(4) D

[6]

a b c

19 What is the solution set of the equation $3x^2 - 34x - 24 = 0$?

(1) $\{-2,6\}$

(2) $\{-12,\frac{2}{3}\}$

(3) $\{-\frac{2}{3},12\}$

(4) $\{-6,2\}$

Use this space for computations.

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$$x = \frac{-(-34) \pm \sqrt{(-34)^2-4(3)(-24)}}{2(3)}$$

$$x = \frac{34 \pm \sqrt{1156-12(-24)}}{6}$$

$$x = \frac{34 \pm \sqrt{1156+288}}{6}$$

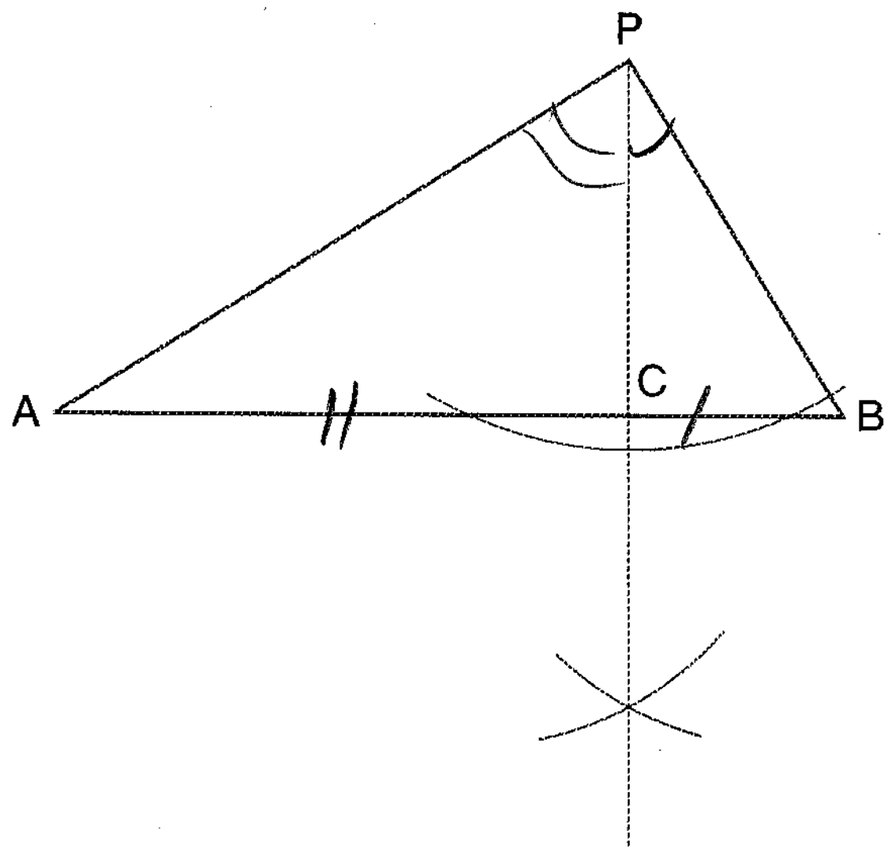
$$x = \frac{34 \pm \sqrt{1444}}{6}$$

$$x = \frac{34 \pm 38}{6}$$

$$x = \frac{72}{6} \quad x = \frac{-4}{6}$$

$$x = 12 \quad x = -\frac{2}{3}$$

20 In the accompanying diagram of a construction, what does $\overline{PC}$ represent?



(1) an altitude drawn to $\overline{AB}$

(2) a median drawn to $\overline{AB}$ No $\overline{AC} \neq \overline{CB}$

(3) the bisector of $\angle APB$ No $\angle APC \neq \angle BPC$

(4) the perpendicular bisector of $\overline{AB}$ No $\overline{AC} \neq \overline{CB}$

21 If $2ax - 5x = 2$, then x is equivalent to

(1) $\frac{2+5a}{2a}$

(2) $\frac{1}{a-5}$

(3) $\frac{2}{2a-5}$

(4) $7-2a$

$$2ax - 5x = 2$$

$$x(2a-5) = 2$$

$$x = \frac{2}{2a-5}$$

22 If $a > 0$, then $\sqrt{9a^2 + 16a^2}$ equals

(1) $\sqrt{7a}$

(2) $5\sqrt{a}$

(3) $5a$

(4) $7a$

$$\sqrt{9a^2+16a^2}$$

$$\sqrt{25a^2}$$

$$\sqrt{25}\sqrt{a^2}$$

$$5a$$

23 What is the sum of $\frac{2}{x}$ and $\frac{x}{2}$?

(1) 1

(2) $\frac{2+x}{2x}$

(3) $\frac{4+x}{2x}$

(4) $\frac{4+x^2}{2x}$

$\frac{2}{x} + \frac{x}{2}$

$\frac{2(2) + x(x)}{x(2)}$

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

Use this space for computations.

24 Five people have volunteered to work on an awards dinner at Madison High School. How many different committees of four can be formed from the five people?

(1) 1

(2) 5

(3) 10

(4) 20

$_5C_4$

$\frac{5 \times 4 \times 3 \times 2}{4 \times 3 \times 2 \times 1} = \frac{5}{1}$

25 The inequality $\frac{1}{2}x + 3 < 2x - 6$ is equivalent to

(1) $x < -\frac{5}{6}$

(2) $x > -\frac{5}{6}$

(3) $x < 6$

(4) $x > 6$

M(2)

$\frac{1}{2}x + 3 < 2x - 6$

$x + 6 < 4x - 12$

$-x \quad\quad -x$

$6 < 3x - 12$

$+12 \quad\quad +12$

$18 < 3x$

$6 < x$

26 In the coordinate plane, the points (2,2) and (2,12) are the endpoints of a diameter of a circle. What is the length of the radius of the circle?

(1) 5

(2) 6

(3) 7

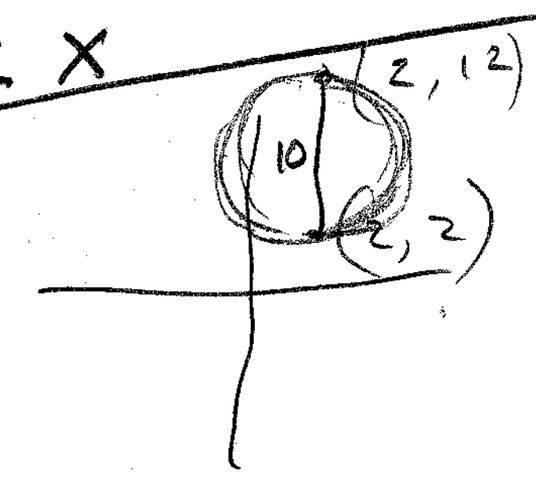
(4) 10

$d = 10$

$r = \frac{1}{2}d$

$r = \frac{1}{2}10$

$r = 5$



27 Which expression represents the number of yards in x feet?

(1) $\frac{x}{12}$

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

(3) $3x$

(4) $12x$

1 yard = 3 feet

yards	feet
1	3
2	6
3	9
4	12
$\frac{x}{3}$	x

28 Which equation illustrates the associative property of addition?

(1) $x + y = y + x$
(2) $3(x + 2) = 3x + 6$
(3) $(3 + x) + y = 3 + (x + y)$
(4) $3 + x = 0$

Use this space for computations.

29 If $2x^2 - x + 6$ is subtracted from $x^2 + 3x - 2$, the result is

(1) $x^2 + 2x - 8$
(2) $x^2 - 4x + 8$
(3) $-x^2 + 2x - 8$
(4) $-x^2 + 4x - 8$

$$x^2 + 3x - 2 - (2x^2 - x + 6)$$

$$\begin{array}{r} x^2 + 3x - 2 \\ -2x^2 + x - 6 \\ \hline -x^2 + 4x - 8 \end{array}$$

30 The expression $(a^2 + b^2)^2$ is equivalent to

(1) $a^4 + b^4$
(2) $a^4 + a^2b^2 + b^4$
(3) $a^4 + 2a^2b^2 + b^4$
(4) $a^4 + 4a^2b^2 + b^4$

$$(a^2 + b^2)(a^2 + b^2)$$

$$a^{(2+2)} + a^2b^2 + b^2a^2 + b^{(2+2)}$$

$$a^4 + 2a^2b^2 + b^4$$

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 Julio's wages vary directly as the number of hours that he works. If his wages for 5 hours are $29.75, how much will he earn for 30 hours?

$\frac{\text{wages}}{\text{hours}} \Rightarrow \frac{29.75}{5} = \frac{?}{30}$

$29.75(30) = 5(?)$

$892.5 = 5(?)$

$\frac{892.5}{5} = ?$

$178.50

32 TOP Electronics is a small business with five employees. The mean (average) weekly salary for the five employees is $360. If the weekly salaries of four of the employees are $340, $340, $345, and $425, what is the salary of the fifth employee?

$\bar{X} = \frac{X_1 + X_2 + X_3 + X_4 + X_n}{n}$

$360 = \frac{340 + 340 + 345 + 425 + X_5}{5}$

$360 = \frac{1450 + X_5}{5}$

$1800 = 1450 + X_5$

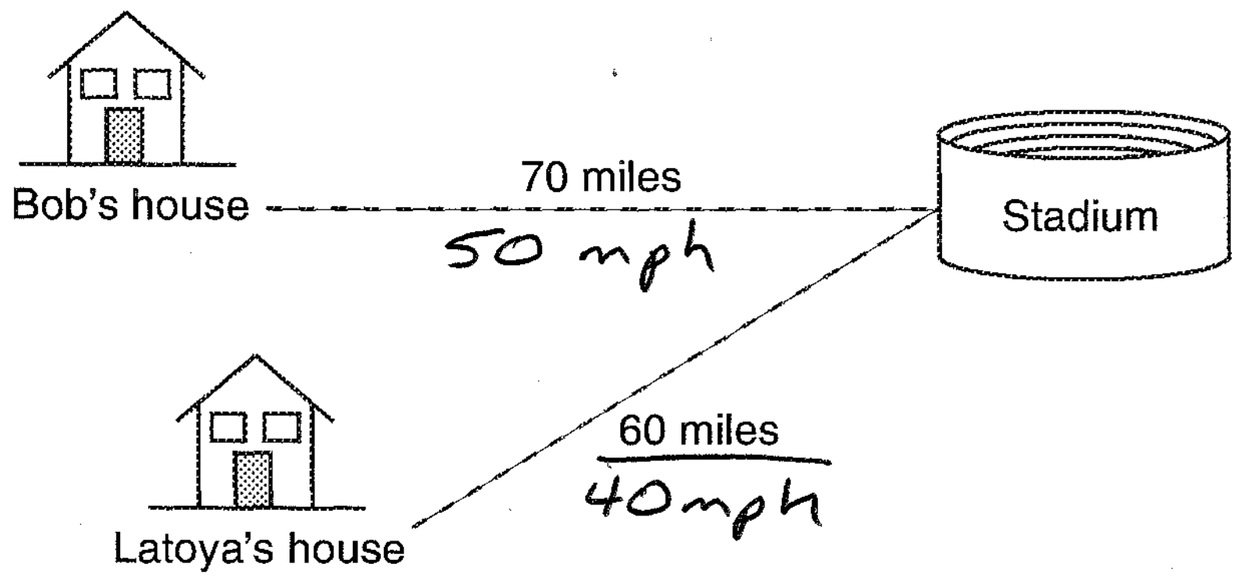
$-1450 \quad -1450$

$350 = X_5$

The fifth employee makes $350.00 per week

Check $\frac{1450+350}{5} = \frac{1800}{5} = 360$ ✓

33 Bob and Latoya both drove to a baseball game at a college stadium. Bob lives 70 miles from the stadium and Latoya lives 60 miles from it, as shown in the accompanying diagram. Bob drove at a rate of 50 miles per hour, and Latoya drove at a rate of 40 miles per hour. If they both left home at the same time, who got to the stadium first?



$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

Bob	Latoya
$\frac{70 \text{ miles}}{50 \text{ mph}}$	$\frac{60 \text{ miles}}{40 \text{ mph}}$
$\frac{7}{5}$ hours	$\frac{6}{4}$ hours
$1\frac{2}{5}$ hour	$1\frac{2}{4}$ hours $\Rightarrow 1\frac{1}{2}$ hours

Bob got there first

$1\frac{2}{5} < 1\frac{1}{2}$

34 A car dealer has 22 vehicles on his lot. If 8 of the vehicles are vans and 6 of the vehicles are red, and 10 vehicles are neither vans nor red, how many red vans does he have on his lot?

Step 1 / Write what you know

	Vans	Not Vans	Total
Red			6
Not Red		10	
Total	8		22

Step 2 Fill in the blanks

	Vans	Not Vans	Total
Red	2	4	6
Not Red	6	10	16
Total	8	14	22

Step 3 Answer the Question

There are **2 Red Vans**

35 In Jackson County, Wyoming, license plates are made with two letters (*A* through *Z*) followed by three digits (0 through 9). The plates are made according to the following restrictions:

- the first letter must be *J* or *W*, and the second letter can be any of the 26 letters in the alphabet
- no digit can be repeated

How many different license plates can be made with these restrictions?

	1st Letter	2nd Letter	1st Digit	2nd Digit	3rd Digit
# of Choices	2	26	10	9	8
	J or W	Any Letter	Any Number	Any Number Except 1st Digit	Any Number Except 1st or 2nd Digit

$2 \times 26 \times 10 \times 9 \times 8 = 37{,}440$ different plates

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 Using only 32-cent and 20-cent stamps, Charlie put \$3.36 postage on a package he sent to his sister. He used twice as many 32-cent stamps as 20-cent stamps. Determine how many of *each* type of stamp he used.

Let X = number of 32¢ stamps

Let Y = number of 20¢ stamps

Change \$3.36 to 336¢

$32X + 20Y = 336$

$X = 2Y$

$32(2Y) + 20Y = 336$

$64Y + 20Y = 336$

$84Y = 336$

$Y = \frac{336}{84}$

$Y = 4$

$X = 2Y$

$X = 2(4)$

$X = 8$

He used
8 32¢ stamps
and
4 20¢ stamps

Answer

Check

$32X + 20Y = 336$

$32(8) + 20(4) = 336$

$256 + 80 = 336$

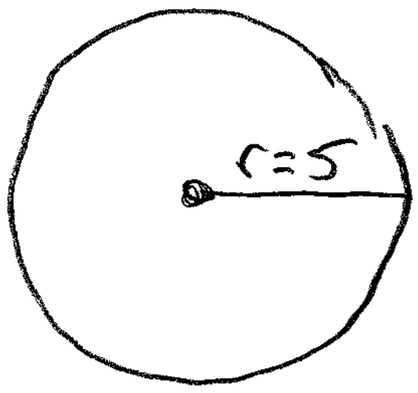
$336 = 336$ ✓

$X = 2Y$

$8 = 2(4)$

$8 = 8$ ✓

37 A wheel has a radius of 5 feet. What is the minimum number of *complete* revolutions that the wheel must make to roll at least 1,000 feet?



Circumference $= \pi d$

$d = 2r$

$d = 2(5)$

$d = 10$

$C = \pi(10)$

$C = 10\pi$

$$\frac{1000}{10\pi} = 31.83098862$$

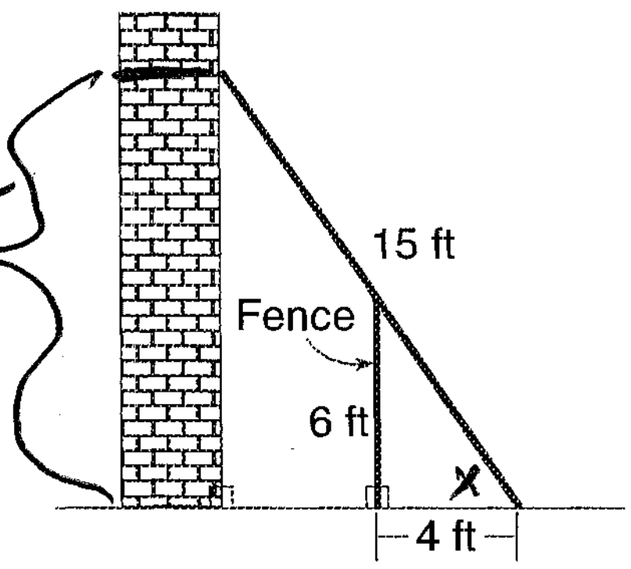
Must round up, because 31 complete revolutions is a little less than 1,000 feet.

32 Complete Revolutions

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 In the accompanying diagram, the base of a 15-foot ladder rests on the ground 4 feet from a 6-foot fence.



SOH-CAH-TOA

$\sin = \frac{\text{opposite}}{\text{hypotenuse}}$

$\cos = \frac{\text{adjacent}}{\text{hypotenuse}}$

$\tan = \frac{\text{opposite}}{\text{adjacent}}$

a If the ladder touches the top of the fence and the side of a building, what angle, to the *nearest degree*, does the ladder make with the ground?

b Using the angle found in part *a*, determine how far the top of the ladder reaches up the side of the building, to the *nearest foot*.

$\tan x = \frac{\text{opposite}}{\text{adjacent}} = \frac{6}{4}$

Set Calculator to Degree Mode

$\arctan \frac{6}{4} = 56.30993247$

nearest degree = 56° Answer to Part a

Part B

$\sin 56° = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{\text{opposite}}{15}$

$15(\sin 56°) = \text{opposite}$

$12.43556359 = \text{opposite}$

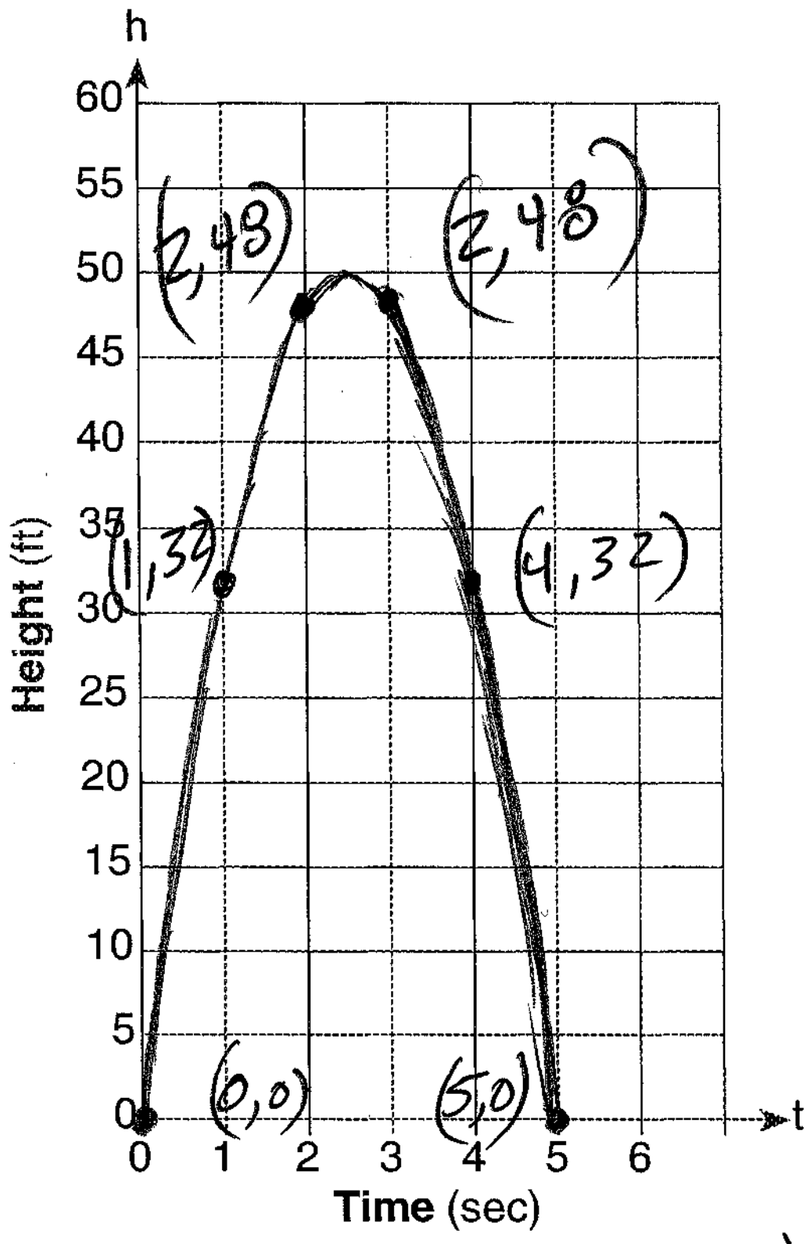
nearest foot = 12 feet Answer to Part b

39 Tom throws a ball into the air. The ball travels on a parabolic path represented by the equation $h = -8t^2 + 40t$, where h is the height, in feet, and t is the time, in seconds.

a On the accompanying set of axes, graph the equation from $t = 0$ to $t = 5$ seconds, including all integral values of t from 0 to 5.

b What is the value of t at which h has its greatest value?

Part a



(X) t	$-8t^2+40t$	(Y) h
0	$-8(0)^2+40(0)$	0
1	$-8(1)^2+40(1)$	32
2	$-8(2)^2+40(2)$	48
3	$-8(3)^2+40(3)$	48
4	$-8(4)^2+40(4)$	32
5	$-8(5)^2+40(5)$	0

These values were checked w/ a graphing calculator.
Input $y = -8x^2+40x$

Part b

axis of symmetry $= \frac{-b}{2a} = \frac{-(40)}{2(-8)} = \frac{-40}{-16} = 2.5$

$-8t^2+40t = 0$

$a=-8 \quad b=40 \quad c=0$

Turning Point of Parabola is when t = axis of symmetry

$y = -8(2.5)^2 + 40(2.5) = 50$

h has its greatest value when $t = 2.5$

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

MATHEMATICS A

Monday, January 26, 2004 — 1:15 to 4:15 p.m., only

ANSWER SHEET

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

Teacher ..... Steve Watson ..... School ..... THS @ PH .....

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

Part I

Answer all 30 questions in this part.

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

Tear Here

Signature