The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

MATHEMATICS A

Tuesday, January 25, 2000 — 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 35 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 for the questions in Parts II, III, and IV directly in this booklet. Clearly indicate the necessary steps you take, 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 paper, 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 paper cannot be accepted if you fail to sign this declaration.

Notice...

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. Record your answers in the spaces provided on the separate answer sheet. [40]

Use this space for computations.

1 The expression $\sqrt{93}$ is a number between

(1) 3 and 9
(2) 8 and 9
(3) 9 and 10
(4) 46 and 47

$\sqrt{81} = 9$
$\sqrt{100} = 10$
$9 < \sqrt{93} < 10$

2 Which number has the greatest value?

(1) $1\frac{2}{3}$ 1.66
(2) $\sqrt{2}$ 1.414...
(3) $\frac{\pi}{2}$ 1.5707...
(4) 1.5 1.50

3 Mary says, "The number I am thinking of is divisible by 2 or it is divisible by 3." Mary's statement is false if the number she is thinking of is

(1) 6 2+3 work
(2) 8 2 works
(3) 11 Neither 2 nor 3 divides 11
(4) 15 3 works

4 Which expression is a factor of $x^2 + 2x - 15$?

(1) $(x - 3)$
(2) $(x + 3)$
(3) $(x + 15)$
(4) $(x - 5)$

$x^2 + 2x - 15 = (x+5)(x-3)$

5 What was the median high temperature in Middletown during the 7-day period shown in the table below?

Daily High Temperature in Middletown	
Day	**Temperature (°F)**
Sunday	68
Monday	73
Tuesday	73
Wednesday	75
Thursday	69
Friday	67
Saturday	63

(1) 69
(2) 70
(3) 73
(4) 75

Median means middle

63
67
68
69
73
73
75

6 If the number represented by $n - 3$ is an odd integer, which expression represents the next greater odd integer?

(1) $n - 5$
(2) $n - 2$
(3) $n - 1$
(4) $n + 1$

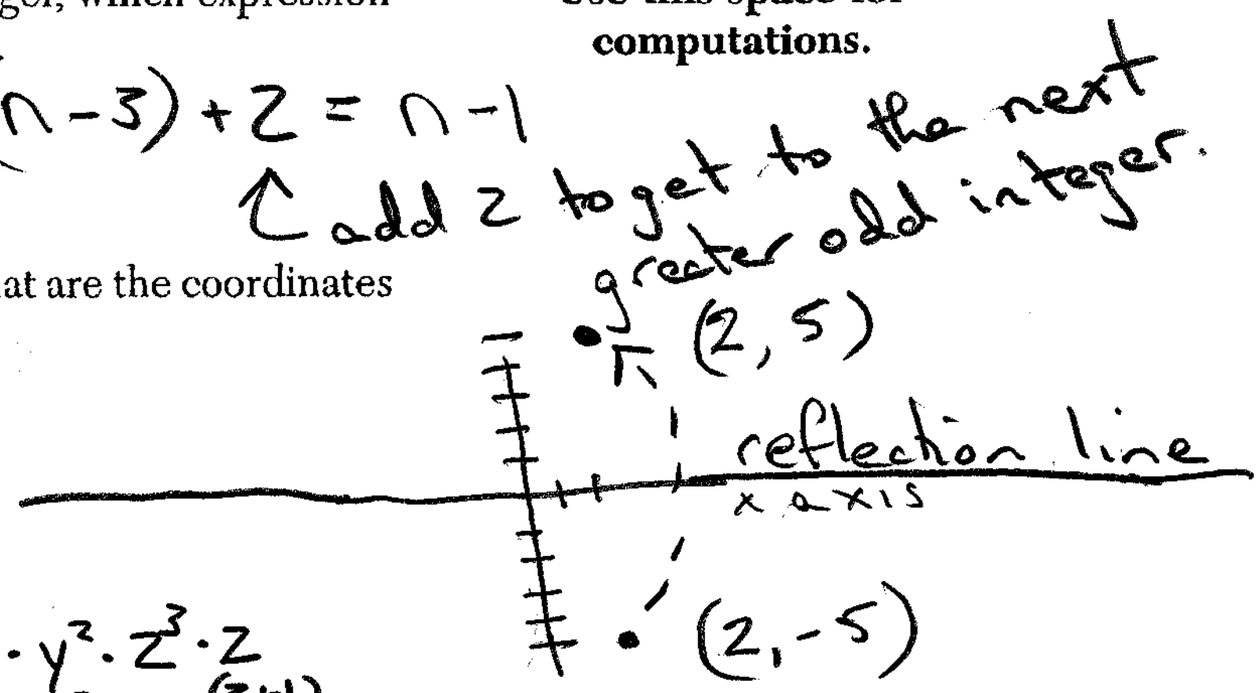
Use this space for computations.

$(n-3)+2 = n-1$

↑ add 2 to get to the next greater odd integer.

7 When the point (2,–5) is reflected in the x-axis, what are the coordinates of its image?

(1) (–5,2)
(2) (–2,5)
(3) (2,5)
(4) (5,2)



8 The expression $(x^2z^3)(xy^2z)$ is equivalent to

(1) $x^2y^2z^3$
(2) $x^3y^2z^4$
(3) $x^3y^3z^4$
(4) $x^4y^2z^5$

$x^2 \cdot x \cdot y^2 \cdot z^3 \cdot z$

$x^{(2+1)} \cdot y^2 \cdot z^{(3+1)}$

$x^3 \quad y^2 \quad z^4$

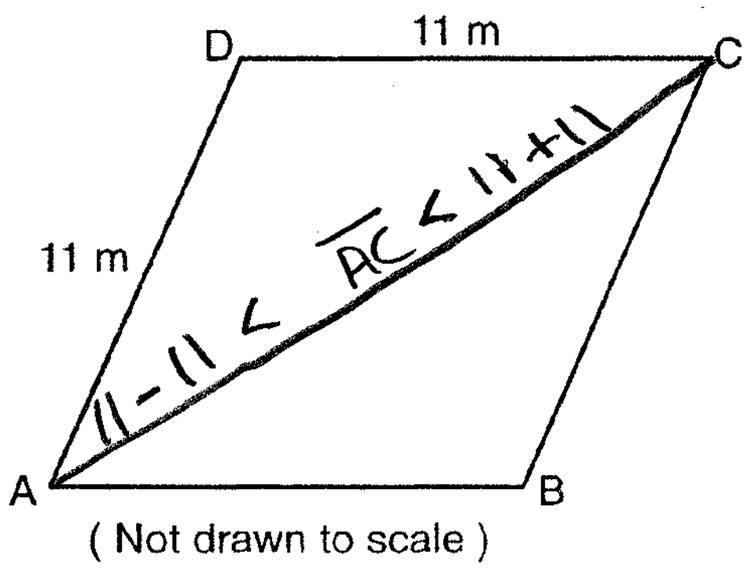
9 Twenty-five percent of 88 is the same as what percent of 22?

(1) $12\frac{1}{2}\%$
(2) 40%
(3) 50%
(4) 100%

25% of 88 $= .25(88) = 22$

$\frac{22}{22} = \frac{x}{100}$ $\quad x = 100$

10 A plot of land is in the shape of rhombus $ABCD$ as shown below.



(Not drawn to scale)

$11 - 11 < \overline{AC} < 11 + 11$

$0 < AC < 22$

Which can *not* be the length of diagonal AC?

(1) 24 m
(2) 18 m
(3) 11 m
(4) 4 m

11 If $9x + 2a = 3a - 4x$, then x equals

(1) a
(2) $-a$
(3) $\frac{5a}{12}$
(4) $\frac{a}{13}$

$9x + 2a = 3a - 4x$

A(4x) $+4x \quad +4x$

$13x + 2a = 3a$

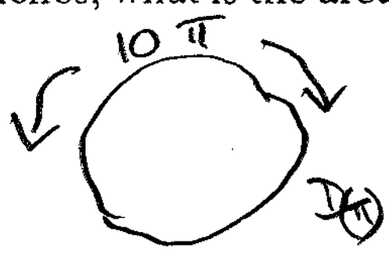
S(2a) $-2a \quad -2a$

$13x = a$

$D_{13} \quad x = \frac{a}{13}$

12 If the circumference of a circle is 10π inches, what is the area, in square inches, of the circle?

(1) 10π
(2) 25π
(3) 50π
(4) 100π



$C = \pi d$
$10\pi = \pi d$
$10 = d$
$5 = r$

Use this space for computations.

$A = \pi r^2$
$A = \pi (5)^2$
$A = 25\pi$

13 How many different 4-letter arrangements can be formed using the letters of the word "JUMP," if each letter is used only once?

(1) 24
(2) 16
(3) 12
(4) 4

$4 \times 3 \times 2 \times 1 = 24$

choices

1rst	2nd	3rd	4th
4	3	2	1
J	U	M	P
U	M	P	
M	P		
P			

14 Sterling silver is made of an alloy of silver and copper in the ratio of 37:3. If the mass of a sterling silver ingot is 600 grams, how much silver does it contain?

(1) 48.65 g
(2) 200 g
(3) 450 g
(4) 555 g

$\frac{\text{parts silver}}{\text{parts copper}} = \frac{37}{3} \Rightarrow \frac{\text{parts silver}}{\text{whole}} = \frac{37}{40}$

$\frac{\text{parts silver}}{\text{whole}} \Rightarrow \frac{37}{40} = \frac{x}{600}$

$40x = 37(600)$
$40x = 22{,}200$
$x = 555$

15 If $t = -3$, then $3t^2 + 5t + 6$ equals

(1) -36
(2) -6
(3) 6
(4) 18

$3(-3)^2 + 5(-3) + 6$
$3(9) + (-15) + 6$
$27 - 15 + 6$
$12 + 6$
18

16 The expression $\frac{y}{x} - \frac{1}{2}$ is equivalent to

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

$\frac{y}{x} - \frac{1}{2}$

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

$\frac{2y - x}{2x}$

17 The party registration of the voters in Jonesville is shown in the table below.

Registered Voters in Jonesville	
Party Registration	**Number of Voters Registered**
Democrat	6,000
Republican	5,300
Independent	3,700

If one of the registered Jonesville voters is selected at random, what is the probability that the person selected is *not* a Democrat?

(1) 0.333
(2) 0.400
(3) 0.600
(4) 0.667

$P(\text{event}) = \frac{\#\text{ desired outcome}}{\text{total possible outcomes}}$

$P(\text{not Democrat}) = \frac{\text{Republican or Independent}}{\text{Total Voters}}$

$P(\text{not Democrat}) = \frac{5300 + 3700}{6000 + 5300 + 3700}$

$P(\text{not Democrat}) = \frac{9000}{15000} = \frac{9}{15} = \frac{3}{5} = .600$

18 If the number of molecules in 1 mole of a substance is 6.02×10^{23}, then the number of molecules in 100 moles is

(1) 6.02×10^{21}
(2) 6.02×10^{22}
(3) 6.02×10^{24}
(4) 6.02×10^{25}

Use this space for computations.

$100 = 10^2$

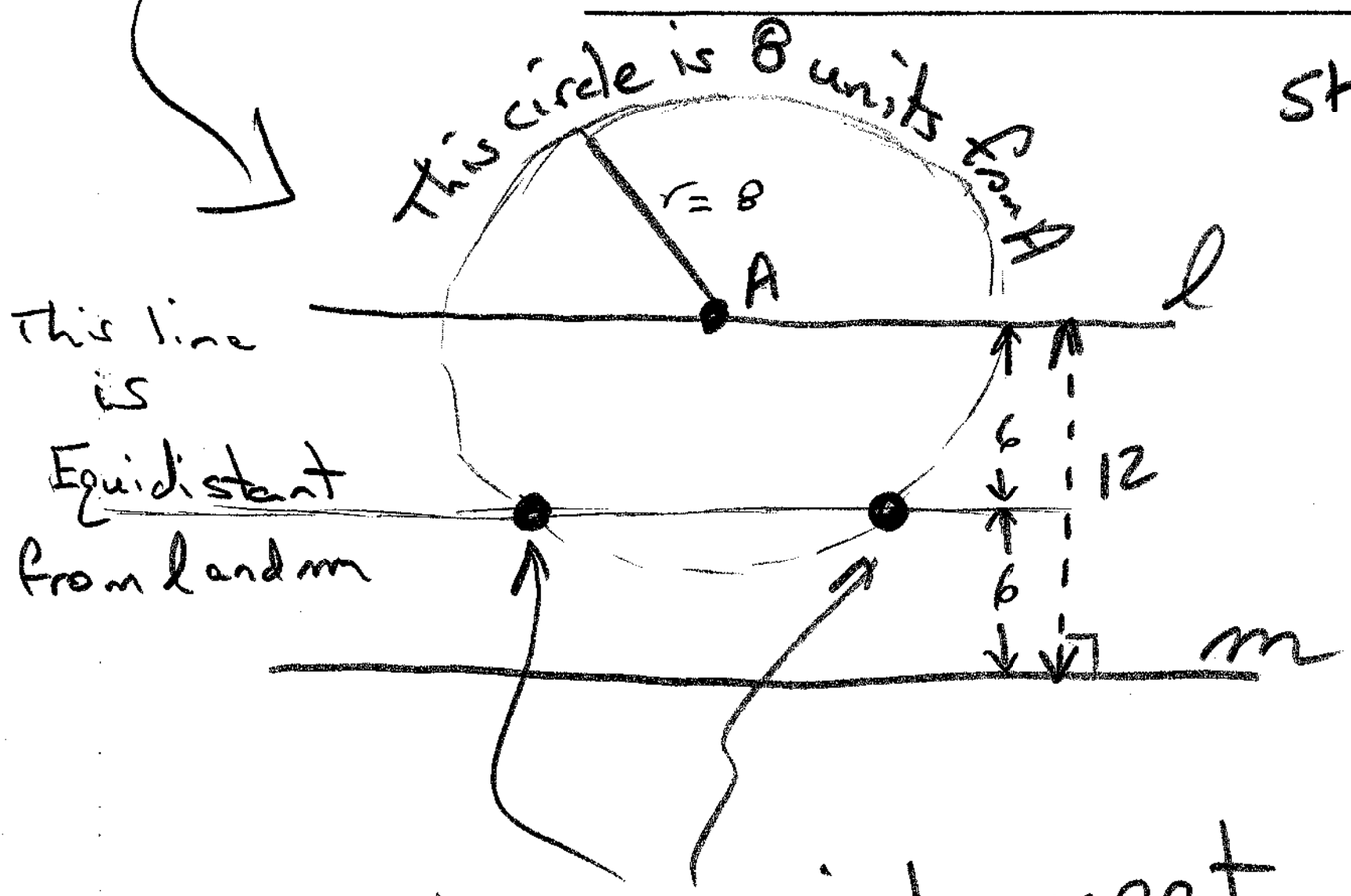
$6.02 \times 10^{23} \times 10^2 = 6.02 \times 10^{(23+2)}$
$= 6.02 \times 10^{25}$

19 When $3a^2 - 2a + 5$ is subtracted from $a^2 + a - 1$, the result is

(1) $2a^2 - 3a + 6$
(2) $-2a^2 + 3a - 6$
(3) $2a^2 - 3a - 6$
(4) $-2a^2 + 3a + 6$

20 The distance between parallel lines ℓ and m is 12 units. Point A is on line ℓ. How many points are equidistant from lines ℓ and m and 8 units from point A?

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



Strategy: Multiply $3a^2 - 2a + 5$ by (-1) and add.

$$\begin{array}{r} a^2 + a - 1 \\ -3a^2 + 2a - 5 \\ \hline -2a^2 + 3a - 6 \end{array}$$

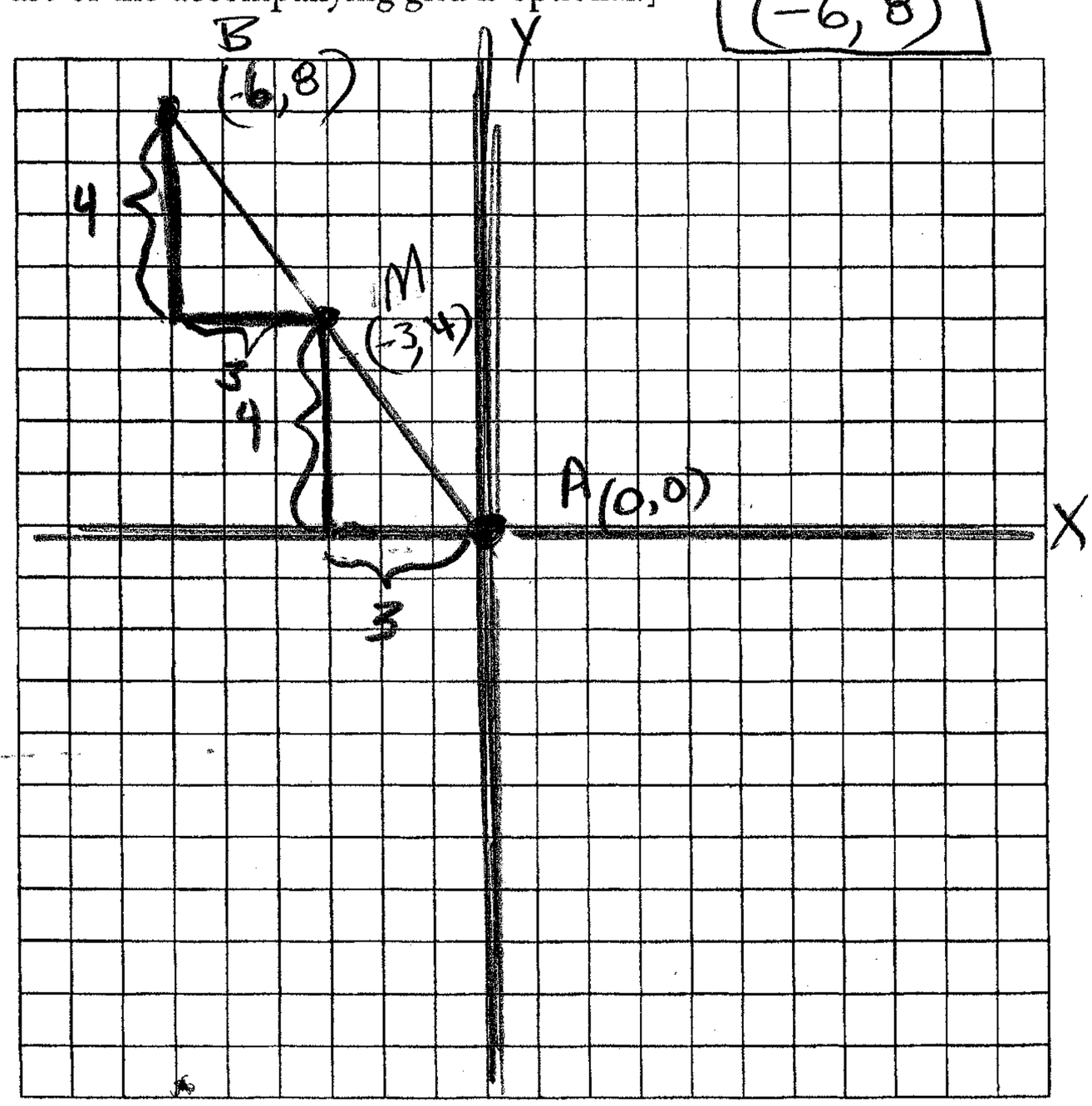
These 2 points meet both conditions
1) equidistant from lines ℓ and m
2) 8 units from point A

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]

21 The midpoint M of line segment AB has coordinates (–3,4). If point A is the origin, (0,0), what are the coordinates of point B? [The use of the accompanying grid is optional.]

(–6, 8)



Another Way to Solve this Problem: Midpoint Formula

$$(X_{mp}, Y_{mp}) = \left(\frac{X_1 + X_2}{2}, \frac{Y_1 + Y_2}{2}\right)$$

$$X_{mp} = \frac{X_1 + X_2}{2} \qquad Y_{mp} = \frac{Y_1 + Y_2}{2}$$

(X_{mp}, Y_{mp}) (X_1, Y_1)

$(-3, 4)$ $(0, 0)$

$$-3 = \frac{0 + X_2}{2} \qquad 4 = \frac{0 + Y_2}{2}$$

$$-6 = X_2 \qquad 8 = Y_2$$

$(X_2, Y_2) = \boxed{(-6, 8)}$

22 Mary and Amy had a total of 20 yards of material from which to make costumes. Mary used three times more material to make her costume than Amy used, and 2 yards of material was not used. How many yards of material did Amy use for her costume?

Let x be the amount Amy used

Let $3x$ be the amount Mary used

Let $20 - 2$ be the total amount used

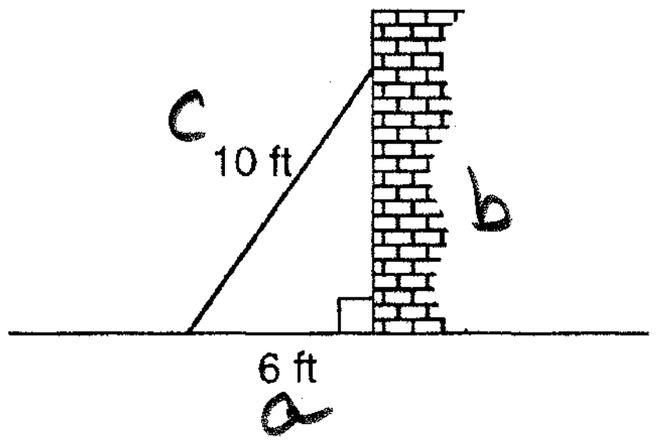
$$3x + x = 20 - 2$$

$$4x = 18$$

$$x = 4.5$$

Amy used 4.5 yards of material

23 A wall is supported by a brace 10 feet long, as shown in the diagram below. If one end of the brace is placed 6 feet from the base of the wall, how many feet up the wall does the brace reach?



(hypotenuse = c)

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

$$(6)^2 + b^2 = (10)^2$$

$$36 + b^2 = 100$$

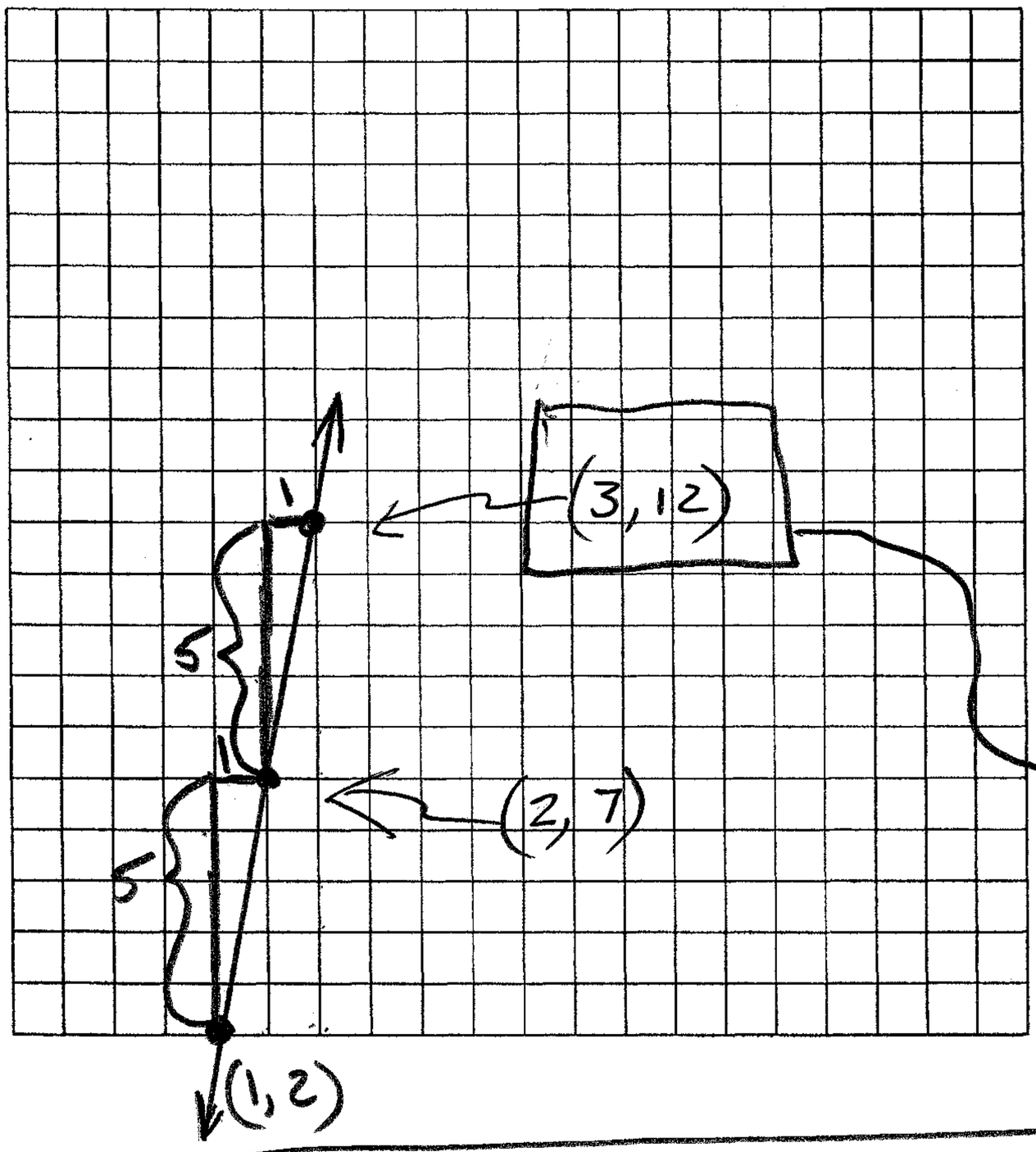
$$b^2 = 64$$

$$\sqrt{b^2} = \sqrt{64}$$

$$b = 8$$

The brace reaches 8 feet up the wall

24 A straight line with slope 5 contains the points (1,2) and (3,*K*). Find the value of *K*. [The use of the accompanying grid is optional.]



$m = 5 = \frac{5}{1} = \frac{\text{rise}}{\text{run}}$

start w/ (1, 2) and go up 5 over 1 twice.

The value of k is 12

Second Solution

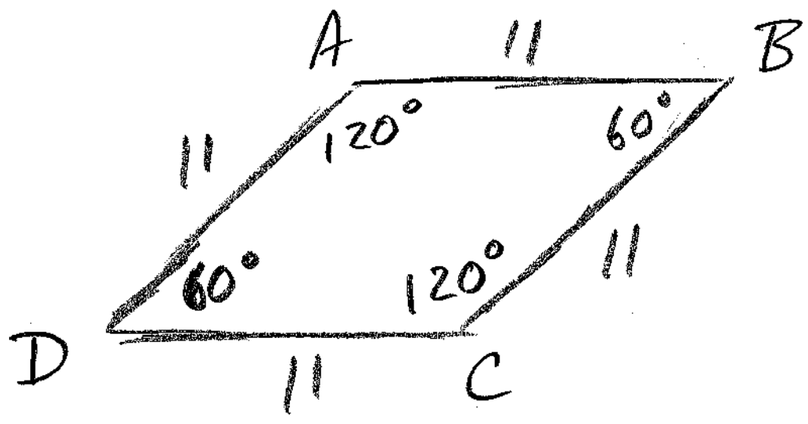
Step 1 Find Equation	$y = mx + b$	$y = mx + b$
$y = 2$	$2 = 5(1) + b$	$y = 5x - 3$
$m = 5$	$2 = 5 + b$	
$x = 1$	$-3 = b$	
$b = ?$		

Step 2: Substitute $x = 3$

$y = 5(3) - 3$

$y = 15 - 3 = \boxed{12}$ ← The value of K is 12

25 Al says, "If *ABCD* is a parallelogram, then *ABCD* is a rectangle." Sketch a quadrilateral *ABCD* that shows that Al's statement is *not* always true. Your sketch must show the length of each side and the measure of each angle for the quadrilateral you draw.



This Quadrilateral ABCD is a rhombus

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. [15]

26 Judy needs a mean (average) score of 86 on four tests to earn a midterm grade of B. If the mean of her scores for the first three tests was 83, what is the *lowest* score on a 100-point scale that she can receive on the fourth test to have a midterm grade of B?

Answer

Judy needs a score of 95

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

$$86 = \frac{83 + 83 + 83 + X_4}{4}$$

$$86 = \frac{249 + X_4}{4}$$

$$344 = 249 + X_4$$

$$-249 \quad -249$$

$$95 = X_4$$

Check

$$86 = \frac{249 + 95}{4}$$

$$86 = \frac{344}{4}$$

$$86 = 86 \checkmark$$

27 A truck traveling at a constant rate of 45 miles per hour leaves Albany. One hour later a car traveling at a constant rate of 60 miles per hour also leaves Albany traveling in the same direction on the same highway. How long will it take for the car to catch up to the truck, if both vehicles continue in the same direction on the highway?

Let H equal the time the truck travels

Let $H(45)$ equal the distance the truck travels

Let $(H-1)$ equal the time the car travels

Let $(H-1)60$ equal the distance the car travels

We want to know when $H(45) = (H-1)60$

$$45H = 60H - 60$$

$$-45H \quad -45H$$

$$0 = 15H - 60$$

$$+60 \quad +60$$

$$60 = 15H$$

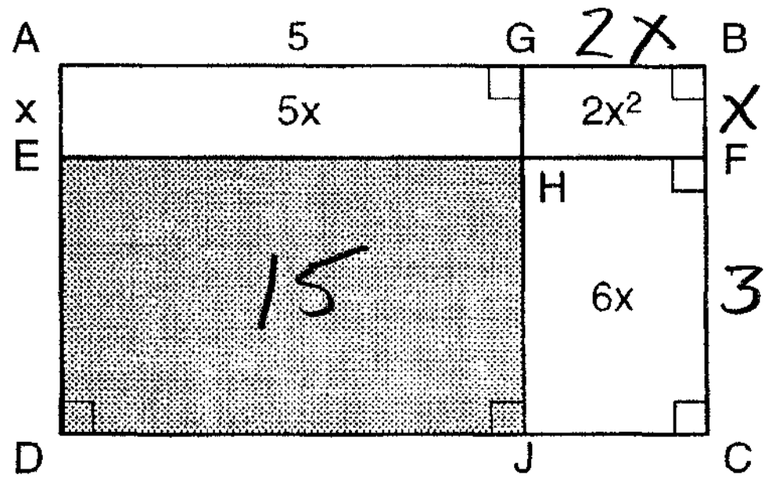
$$4 = H$$

The car catches up to the truck at $(H-1)$

$4 - 1 = \boxed{3 \text{ hours}}$

Answer

28 In the figure below, the large rectangle, $ABCD$, is divided into four smaller rectangles. The area of rectangle $AEHG = 5x$, the area of rectangle $GHFB = 2x^2$, the area of rectangle $HJCF = 6x$, segment $AG = 5$, and segment $AE = x$.



AE = BF = X

(EB)(BF) = 2X²

(EB)(X) = 2X²

EB = 2X

EB

(EB)(FC) = 6X

2X (FC) = 6X

(FC) = 3

a Find the area of the shaded region.

15 square units

(FC)(AE) = shaded area

(3)(5) = 15

b Write an expression for the area of rectangle $ABCD$ in terms of x.

(2X + 5)(X + 3)

$2x^2 + 11x + 15$

29 *a* On the set of axes provided below, sketch a circle with a radius of 3 and a center at (2,1) and also sketch the graph of the line $2x + y = 8$.

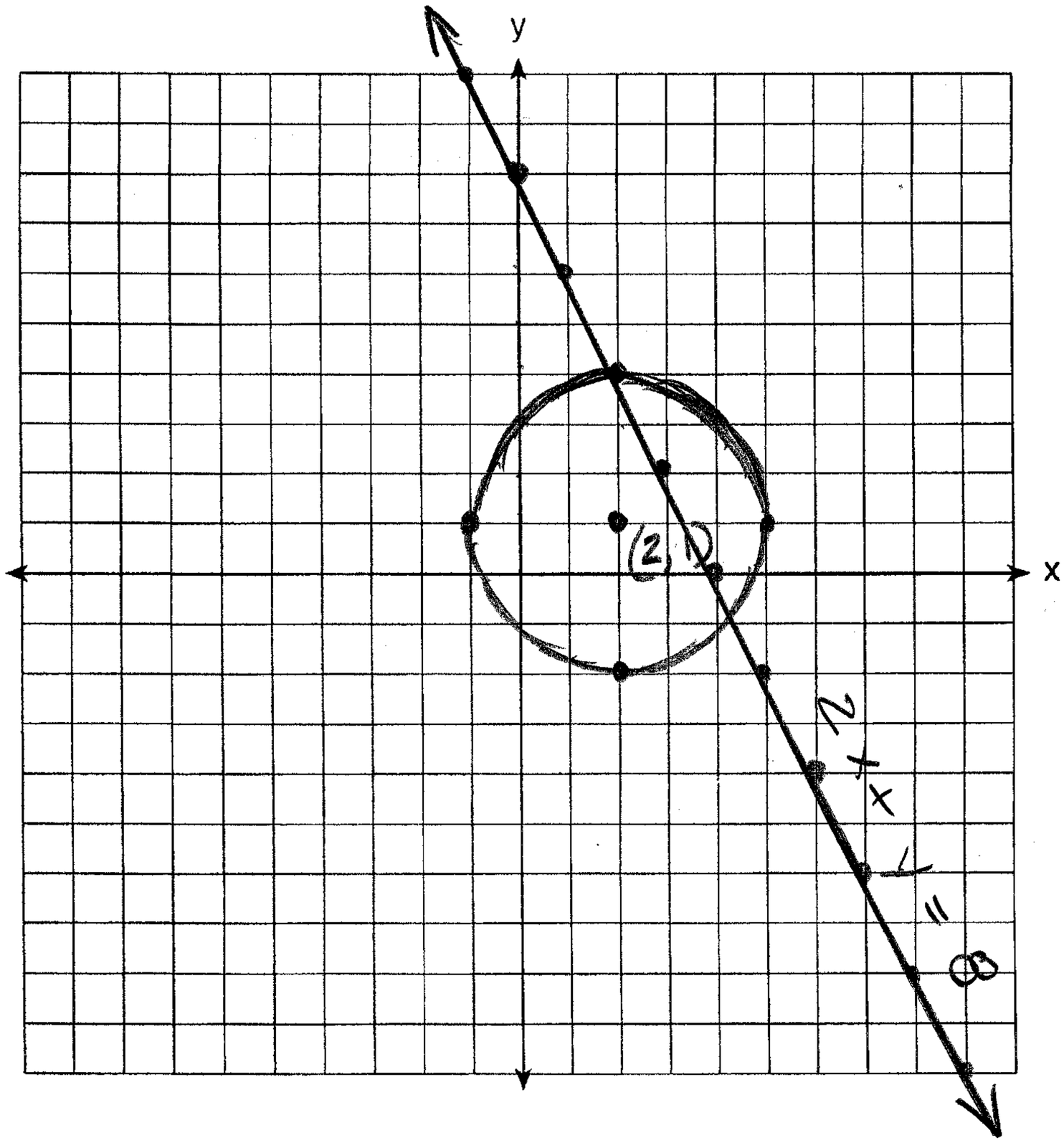
$y = mx + b$

$2x + y = 8$

$y = -2x + 8$

$m = \frac{-2}{1}$

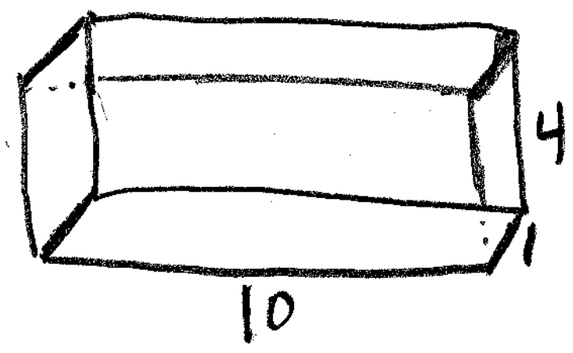
$b = 8$



b What is the total number of points of intersection of the two graphs?

2

30 The volume of a rectangular pool is 1,080 cubic meters. Its length, width, and depth are in the ratio 10:4:1. Find the number of meters in each of the three dimensions of the pool.



length width depth

$(10x)(4x)(1x) = 1080$

$40x^3 = 1080$

$x^3 = 27$

$\sqrt[3]{x^3} = \sqrt[3]{27}$

$x = 3$

The pool's length is 30 meters
" " width is 12 meters
" " depth is 3 meters

Check $(30)(12)(3) = 1080$

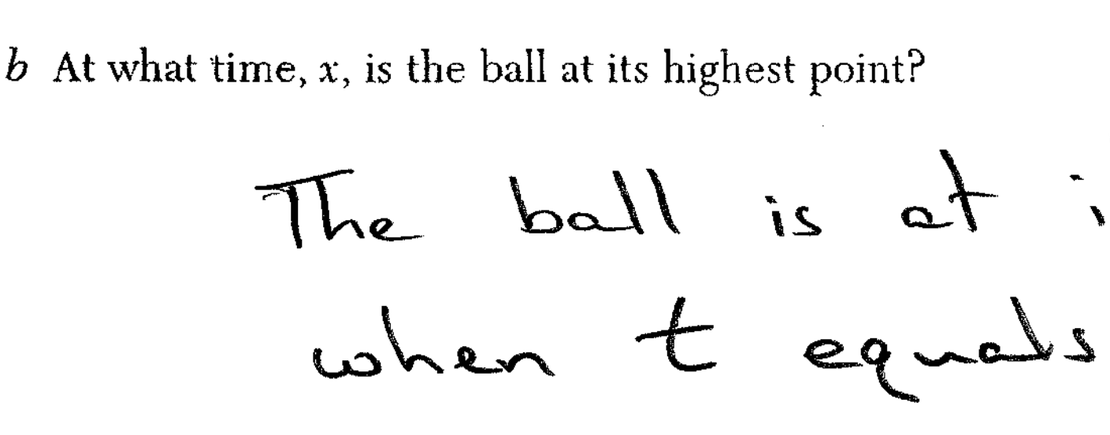
$1080 = 1080$ ✓

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. [20]

31 Amy tossed a ball in the air in such a way that the path of the ball was modeled by the equation $y = -x^2 + 6x$. In the equation, y represents the height of the ball in feet and x is the time in seconds.

a Graph $y = -x^2 + 6x$ for $0 \leq x \leq 6$ on the grid provided below.



Input $y = -x^2 + 6x$ in graphing calculator

X	Y
0	0
1	5
2	8
3	9 ← Vertex
4	8
5	5
6	0

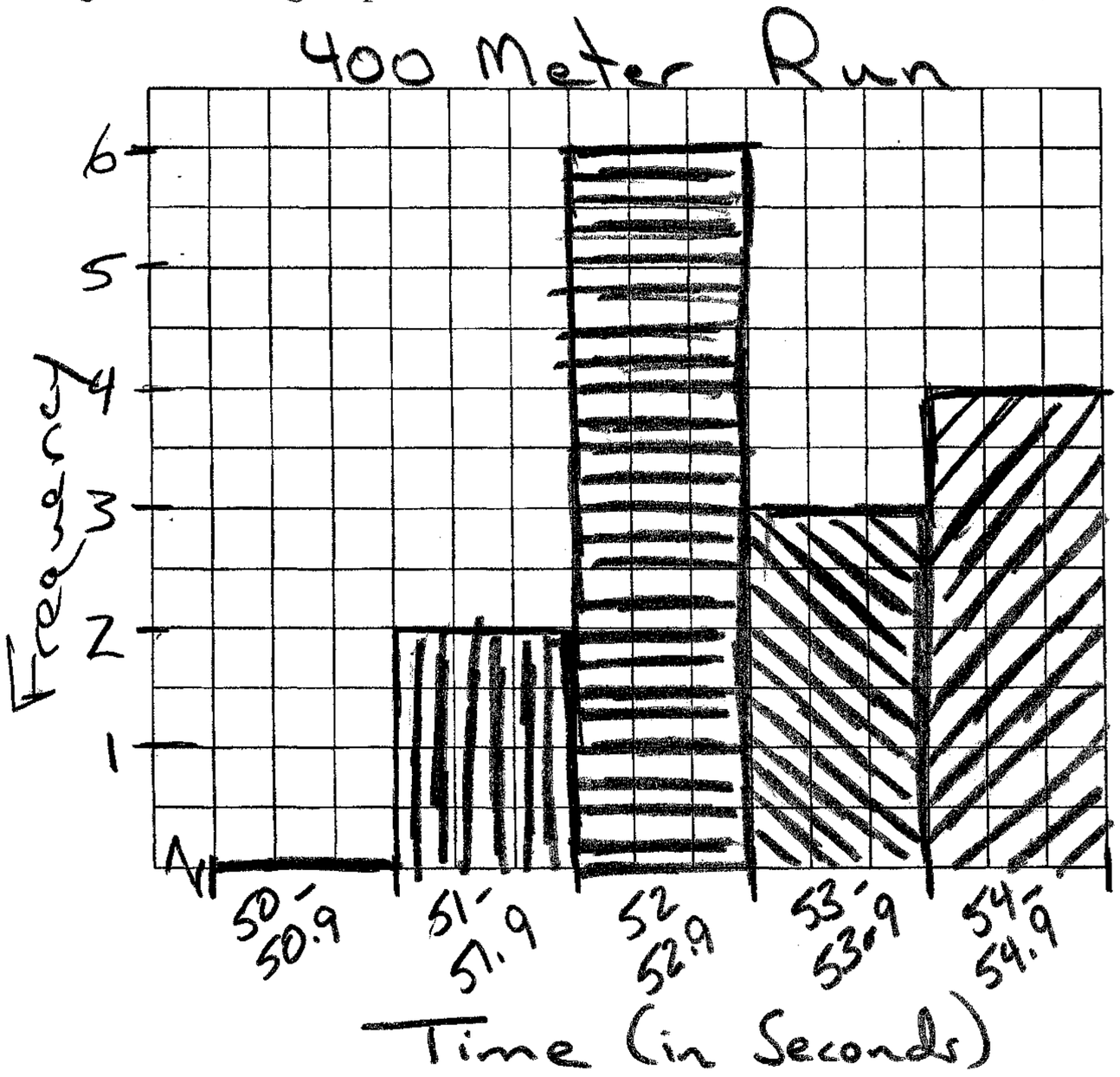
b At what time, x, is the ball at its highest point?

The ball is at its highest point when t equals **3 seconds**

32 In the time trials for the 400-meter run at the state sectionals, the 15 runners recorded the times shown in the table below.

400-Meter Run	
Time (sec)	**Frequency**
50.0–50.9	
51.0–51.9	II
52.0–52.9	⧸⧸⧸⧸ I
53.0–53.9	III
54.0–54.9	IIII

a Using the data from the frequency column, draw a frequency histogram on the grid provided below.



b What percent of the runners completed the time trial between 52.0 and 53.9 seconds?

52→52.9 + 53–53.9
(6) + (3) = 9 runners out of a total of 15

$\frac{9}{15} = .6 =$ 60%

33 A group of 148 people is spending five days at a summer camp. The cook ordered 12 pounds of food for each adult and 9 pounds of food for each child. A total of 1,410 pounds of food was ordered.

a Write an equation *or* a system of equations that describes the above situation and define your variables.

Let A equal the number of adults
Let C equal the number of children

$A + C = 148$ ← Equation #1

Let 12A equal the pounds of food for adults
Let 9C equal the pounds of food for children

$12A + 9C = 1,410$ ← Equation #2

b Using your work from part *a*, find:

(1) the total number of adults in the group

$A + C = 148$

$C = 148 - A$

$12A + 9C = 1,410$

$12A + 9(148 - A) = 1,410$

$12A + 1332 - 9A = 1,410$

$3A + 1332 = 1,410$

$-1332 \quad -1332$

$3A = 78$

$A = 26$

There were 26 adults in the group

(2) the total number of children in the group

$C = 148 - A$

$C = 148 - 26$

$C = 122$

There were 122 children in the group

Check

$122 + 26 = 148$

$148 = 148$ ✓

$12(26) + 9(122) = 1,410$

$312 + 1098 = 1,410$

$1410 = 1410$ ✓

34 Three roses will be selected for a flower vase. The florist has 1 red rose, 1 white rose, 1 yellow rose, 1 orange rose, and 1 pink rose from which to choose.

a How many different 3-rose selections can be formed from the 5 roses?

$${}_5C_3 = \frac{5 \cdot 4 \cdot 3}{3 \cdot 2 \cdot 1} = \frac{10}{1} = 10$$

b What is the probability that 3 roses selected at random will contain 1 red rose, 1 white rose, and 1 pink rose?

$$P(\text{event}) = \frac{\#\text{ desired outcomes}}{\#\text{ possible outcomes}}$$

$$P(\text{rwp}) = \frac{1}{10}$$

c What is the probability that 3 roses selected at random will *not* contain an orange rose?

rwy
rwo
rwp
ryo
ryp
rop
wyo
wyp
wop

$$P(\text{no orange}) = \frac{4}{10} = \frac{2}{5}$$

35 The Excel Cable Company has a monthly fee of $32.00 and an additional charge of $8.00 for each premium channel. The Best Cable Company has a monthly fee of $26.00 and an additional charge of $10.00 for each premium channel. The Horton family is deciding which of these two cable companies to subscribe to.

a For what number of premium channels will the total monthly subscription fee for the Excel and Best Cable companies be the same?

Let p equal the number of premium channels
Let the cost of Excel Cable = $32 + 8p$
Let the cost of Best Cable = $26 + 10p$
Find when $32 + 8p = 26 + 10p$

$-8p \quad -8p$

$32 = 26 + 2p$
$-26 \quad -26$

$6 = 2p$
$3 = p$

3 premium channels cost the same

b The Horton family decides to subscribe to 2 premium channels for a period of one year.

(1) Which cable company should they subscribe to in order to spend less money?

Excel costs $32 + 8p$
$32 + 8(2)$
$32 + 16$
$\$48/mo$

Best costs $26 + 10p$
$26 + 10(2)$
$26 + 20$
$\$46/mo$

The Hortons should subscribe to the Best Cable Co.

(2) How much money will the Hortons save in one year by using the less expensive company?

The Hortons will save $\$2$ per month,
or $\$24$ per year

$12 \times 2 = 24$

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

MATHEMATICS A

Tuesday, January 25, 2000 — 1:15 to 4:15 p.m., only

ANSWER SHEET

Pupil ..... Sex: ☐ Male ☐ Female Grade .....

Teacher ..... School .....

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

Part I

Answer all 20 questions in this part.

1 ... 3	6 ... 3	11 ... 4	16 ... 1
2 ... 1	7 ... 3	12 ... 2	17 ... 3
3 ... 3	8 ... 2	13 ... 1	18 ... 4
4 ... 1	9 ... 4	14 ... 4	19 ... 2
5 ... 1	10 ... 1	15 ... 4	20 ... 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