The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA I

Monday, August 19, 2024 — 8:30 to 11:30 a.m., only

Student Name *Mr. Jibol*

School Name *JMAP*

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

Print your name and the name of your school on the lines above.

A separate answer sheet for **Part I** has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet.

This examination has four parts, with a total of 35 questions. You must answer all questions in this examination. Record 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. All work should be written in pen, except for graphs and drawings, which should be done in pencil. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale.

The formulas that you may need to answer some questions in this examination are found at the end of the examination. This sheet is perforated so you may remove it from this booklet.

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.

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 graphing calculator and a straightedge (ruler) must be available for you to use while taking this examination.

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

Part I

Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For each statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Record your answers on your separate answer sheet. [48]

Use this space for computations.

1 What is the correct factorization of $x^2 + 4x - 12$?

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

(2) $(x - 3)(x + 4)$ (4) $(x - 2)(x + 6)$

2 Which situation can be modeled by a linear function?

(1) A printer can print one page every three seconds.

(2) A bank account earns 0.5% interest each year, compounded annually.

(3) The number of cells in an organism doubles every four days.

(4) The attendance at a professional sports team's games decreases by 1.5% each year.

3 Which expression is equivalent to $3(x^2 - 2x + 3) - (4x^2 + 3x - 1)$?

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

(2) $-x^2 - 8x + 7$ (4) $-x^2 - 9x + 10$

$3x^2 - 6x + 9 \quad -4x^2 - 3x + 1$

$-x^2 - 9x + 10$

4 At Adelynn's first birthday party, each guest brought $1 in coins for her piggy bank. Guests brought nickels, dimes, and quarters for a total of $28. There were twice as many dimes as nickels and 12 more quarters than nickels. Which equation could be used to determine the number of nickels, x, that her guests brought to her party?

(1) $.05x + .10x + .25x = 28$

(2) $.05x + .10(2x) + .25(x + 12) = 28$

(3) $.05(2x) + .10x + .25(x + 12) = 28$

(4) $.05(x + 12) + .10(2x) + .25x = 28$

5 A student creates a fourth-degree trinomial with a leading coefficient of 2 and a constant value of 5. The trinomial could be

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

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

6 When solving the equation $4x^2 - 16 = 0$, Laura wrote $4x^2 = 16$ as her first step. Which property justifies Laura's first step?

(1) distributive property of multiplication over addition

(2) multiplication property of equality

(3) commutative property of addition

(4) addition property of equality

7 Which expression results in an irrational number?

(1) $\sqrt{3} \cdot \sqrt{3}$ $= 3$ (3) $5 \cdot \sqrt{81}$ $= 14$

(2) $-\frac{2}{3} + \frac{1}{4}$ $= \frac{-5}{12}$ (4) $\frac{1}{3} + \sqrt{3}$

8 Which equation has the same solutions as $x^2 + 6x - 18 = 0$?

(1) $(x + 3)^2 = 24$ (3) $(x + 6)^2 = 24$

(2) $(x + 3)^2 = 27$ (4) $(x + 6)^2 = 27$
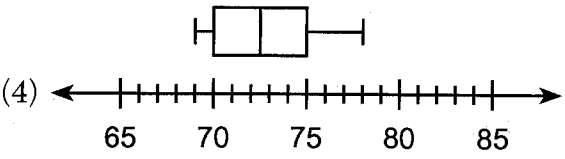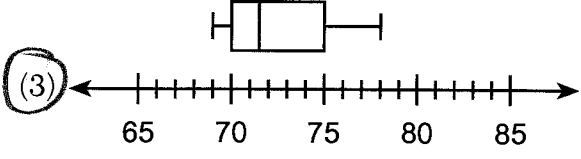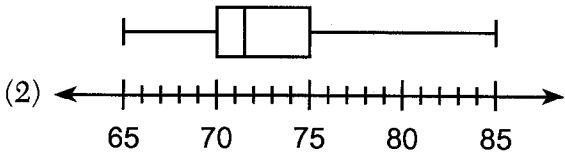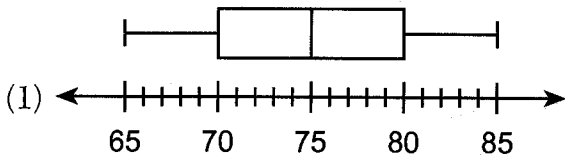
$x^2 + 6x + 9 = 18 + 9$

$(x + 3)^2 = 27$

9 The heights, in inches, of eight football players are given below.

76, 70, 72, 70, 69, 71, 78, 74

Which box plot represents these data?

Handwritten work: 70   75

(69) [70 70] 71 72 [74 76] (78)

MIN   Q1 $\frac{71+72}{2}$ Q3   MAX

71.5 median

(1)

(2)

(3)

(4)

10 A bookstore owner recorded the number of books sold and the profit made selling the books.

Handwritten work: $\frac{425-50}{350-100} = \frac{375}{250} = 1.5$

Books Sold	Profit
100	$50.00
250	$275.00
300	$350.00
350	$425.00

What is the average rate of change, in dollars per book, between 100 and 350 books sold?

(1) 0.50   (3) 1.50

(2) 0.67   (4) 2.00

11 If $f(x) = x^2$, then which function represents a shift of the graph of $f(x)$ 4 units to the right and 3 units down?

(1) $g(x) = (x + 4)^2 + 3$ (3) $h(x) = (x - 4)^2 - 3$

(2) $j(x) = (x + 4)^2 - 3$ (4) $k(x) = (x - 4)^2 + 3$

12 The amount of money a plumber charges is represented by the function $p(h) = 45 + 90h$. The best interpretation of the y-intercept of this function is that the plumber charges

(1) $45 to come to the house

(2) $45 per hour that he works

(3) $90 to come to the house

(4) $90 per hour that he works

13 What is the solution to the inequality $2m - 4 \le 3(2m + 4)$?

(1) $m \le -2$ (3) $m \le -4$

(2) $m \ge -2$ (4) $m \ge -4$

$2m - 4 \le 6m + 12$

$-16 \le 4m$

$-4 \le m$

14 A survey of students at West High School was taken to determine a theme for the prom. The results of the survey are summarized in the table below.

	Beach Party	Hollywood	Broadway
Girls	86	112	68
Boys	123	77	79

$\dfrac{68}{68+79} \approx .46$

Approximately what percentage of the students who chose the Broadway theme were girls?

(1) 26   (3) 46

(2) 27   (4) 68

15 The sum of $2\sqrt{54}$ and $2\sqrt{6}$ is

(1) $4\sqrt{60}$

(2) $8\sqrt{15}$

(3) $7\sqrt{6}$

(4) $8\sqrt{6}$

$2\sqrt{9}\sqrt{6} + 2\sqrt{6}$

$6\sqrt{6} + 2\sqrt{6}$

$8\sqrt{6}$

16 The functions $f(x) = x^2 - 5x - 14$ and $g(x) = x + 2$ are graphed on the same set of axes. What are the solutions to the equation $f(x) = g(x)$?

(1) -14 and 0

(2) 0 and 2

(3) -2 and 8

(4) -2 and 7

$x^2 - 5x - 14 = x + 2$

$x^2 - 6x - 16 = 0$

$(x-8)(x+2) = 0$

17 If $x = 4a^2 - a + 3$ and $y = a - 5$, then which polynomial is equivalent to the product of x and y?

(1) $-17a^2 - 2a - 15$

(2) $-17a^2 + 8a - 15$

(3) $4a^3 - 21a^2 - 2a - 15$

(4) $4a^3 - 21a^2 + 8a - 15$

$4a^2 - a + 3)(a - 5)$

$4a^3 - 20a^2 - a^2 + 5a + 3a - 15$

18 What is an equation of the line that passes through $(3,7)$ and has a slope of 2?

(1) $y - 7 = 2(x - 3)$

(2) $y - 3 = 2(x - 7)$

(3) $y + 7 = 2(x + 3)$

(4) $y + 3 = 2(x + 7)$

19 A geometric sequence with a common ratio of -3 is

(1) $-10, -7, -4, -1, \ldots$

(2) $14, 11, 8, 5, \ldots$

(3) $-2, -6, -18, -54, \ldots$

(4) $4, -12, 36, -108, \ldots$

20 When the equation $6 - ax = ax - 2$ is solved for x in terms of a, and $a \neq 0$, the result is

(1) $4a$ (3) $2a$

(2) $\dfrac{4}{a}$ (4) $\dfrac{2}{a}$

$$6 - ax = ax - 2$$
$$\frac{8}{2a} = \frac{2ax}{2a}$$
$$\frac{4}{a} = x$$

21 Which function has the zeros -1, 3, and -4?

(1) $f(x) = (x + 1)(x - 3)(x - 4)$

(2) $g(x) = (x - 1)(x + 3)(x - 4)$

(3) $h(x) = (x + 1)(x - 3)(x + 4)$

(4) $k(x) = (x - 1)(x + 3)(x + 4)$

22 The expression $5^{a + 2b}$ is equivalent to

(1) $5^a \cdot 5^2 \cdot 5^b$ (3) 25^{2ab}

(2) $5^a \cdot 25^b$ (4) $25^{a + 2b}$

$$5^{a + 2b} = 5^a \cdot 5^{2b} = 5^a \cdot 25^b$$

23 In an arithmetic sequence, the first term is 4 and the third term is -2. What is the common difference?

(1) -1 (3) -3

(2) -2 (4) -6

$$\frac{-2 - 4}{3 - 1} = \frac{-6}{2} = -3$$

24 Joe is ordering water for his swimming pool. He determines the volume of his pool to be about 3240 cubic feet. There are approximately 7.5 gallons of water in 1 cubic foot. A truck load holds 6000 gallons of water.

Which expression would allow Joe to correctly calculate the number of truck loads of water he needs to fill his pool?

(1) $\dfrac{3240 \text{ ft}^3}{1 \text{ pool}} \cdot \dfrac{1 \text{ ft}^3}{7.5 \text{ gal}} \cdot \dfrac{6000 \text{ gal}}{1 \text{ truck load}}$

(2) $\dfrac{3240 \text{ ft}^3}{1 \text{ pool}} \cdot \dfrac{1 \text{ ft}^3}{7.5 \text{ gal}} \cdot \dfrac{1 \text{ truck load}}{6000 \text{ gal}}$

(3) $\dfrac{3240 \text{ ft}^3}{1 \text{ pool}} \cdot \dfrac{7.5 \text{ gal}}{1 \text{ ft}^3} \cdot \dfrac{6000 \text{ gal}}{1 \text{ truck load}}$

(4) $\dfrac{3240 \cancel{\text{ ft}^3}}{1 \text{ pool}} \cdot \dfrac{7.5 \cancel{\text{ gal}}}{1 \cancel{\text{ ft}^3}} \cdot \dfrac{1 \text{ truck load}}{6000 \cancel{\text{ gal}}}$

Answer all 6 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [12]

25 On the set of axes below, graph $f(x) = x^2 + 4x + 1$.
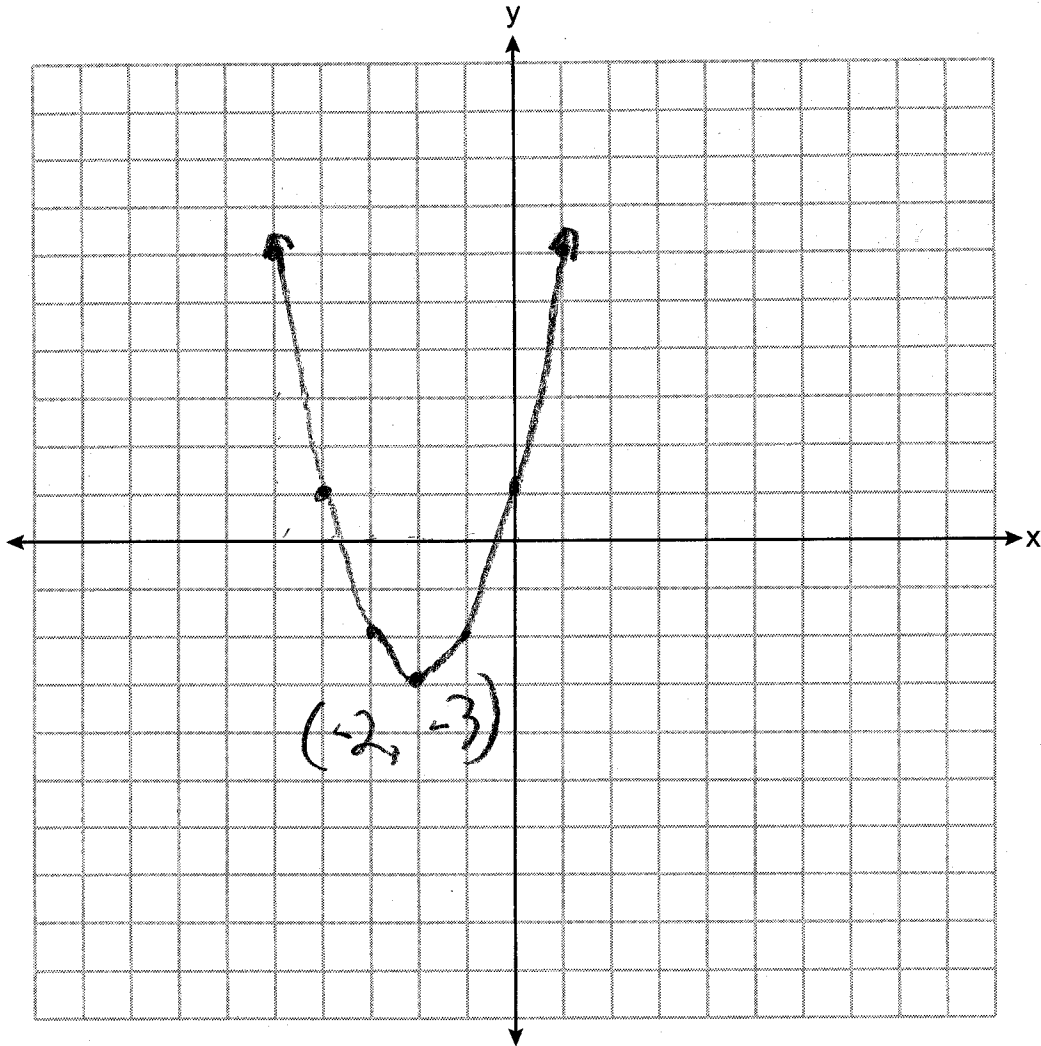
State the coordinates of the minimum.

26 If $f(x) = \dfrac{30x^2}{x+2}$, determine the value of $f\left(\dfrac{1}{2}\right)$.

$$\frac{30\left(\frac{1}{2}\right)^2}{\frac{1}{2}+2}$$

$$\frac{\frac{30}{4}}{\frac{5}{2}}$$

$$\frac{15}{2} \cdot \frac{2}{5}$$

$$3$$

27 Explain why the relation shown in the table below is a function.

x	−1	0	1	2
y	2	4	4	5

For every value of x, there is a unique value of y.

Complete the table below with values for both *x* and *y* so that this new relation is *not* a function.

x	−1	0	1	2	2
y	2	4	4	5	4

28 Solve algebraically for x: $\dfrac{0.05(x - 3)}{0.05} = \dfrac{0.35x - 7.5}{0.05}$

$$x - 3 = 7x - 150$$
$$147 = 6x$$
$$24.5 = x$$

29 Use the quadratic formula to determine the exact roots of the equation $x^2 + 3x - 6 = 0$.

$$x = \frac{-3 \pm \sqrt{3^2 - 4(1)(-6)}}{2(1)} = \frac{-3 \pm \sqrt{33}}{2}$$

30 Factor $5x^3 - 80x$ completely.

$$5x(x^2 - 16)$$

$$5x(x+4)(x-4)$$

Part III

Answer all 4 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

31 The owner of an ice cream stand kept track of the number of ice cream cones that were sold each day of the first week in June. She compared the ice cream sales to the average daily temperature. The data are shown in the table below.

Average Daily Temp. (x)	72	75	81	78	77	76	80
Daily Ice Cream Cone Sales (y)	126	183	263	229	200	185	249

State the linear regression equation for these data, rounding all values to the *nearest hundredth*.

$$y = 15.13x - 959.63$$

State the correlation coefficient, to the *nearest hundredth*, for the line of best fit for these data.

$$.99$$

State what this correlation coefficient indicates about the linear fit of the data.
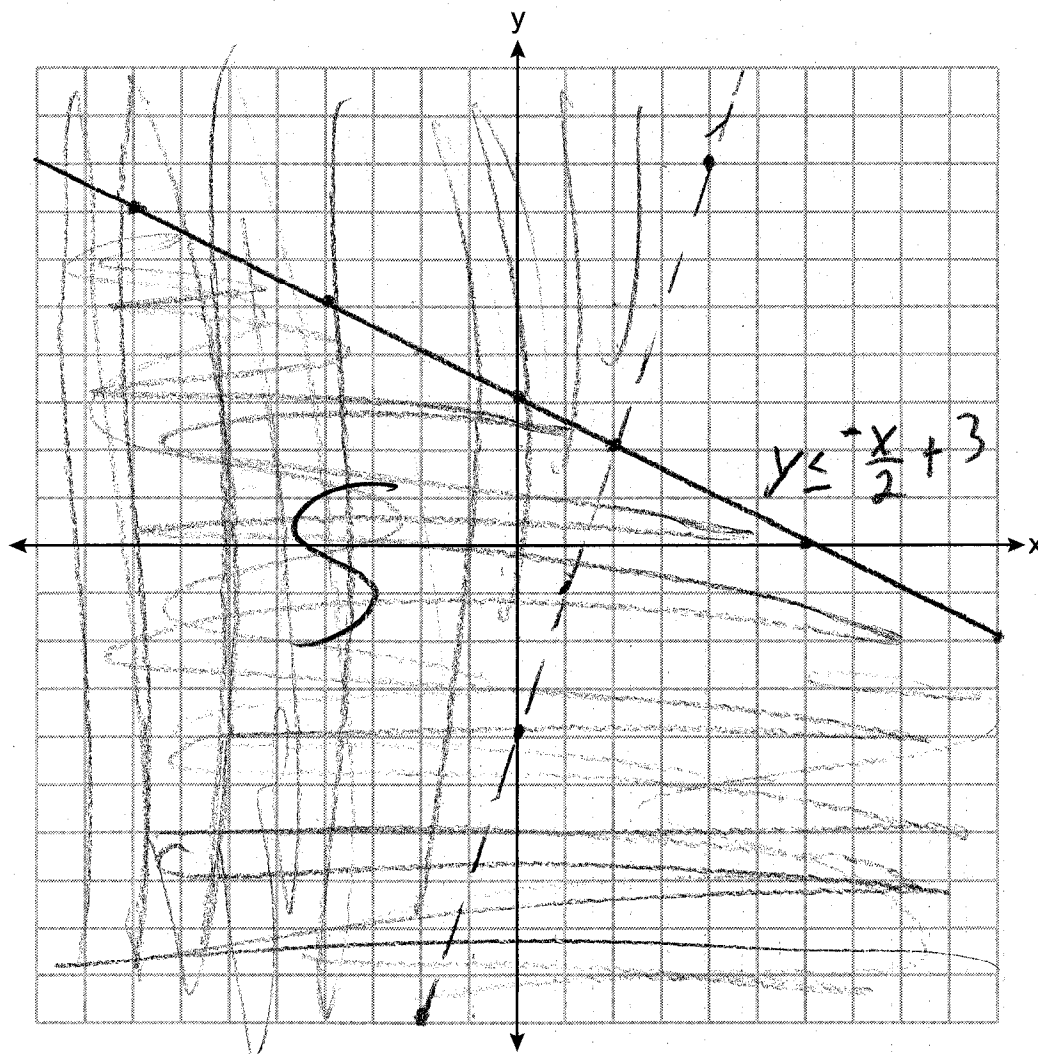
strong

32 Graph the system of inequalities on the set of axes below:

$$y > 3x - 4$$
$$x + 2y \leq 6$$

Label the solution set S.

Is the point (2,2) a solution to the system? Justify your answer. No

$$2 > 3(2) - 4$$
$$2 > 2$$
is not true.

33 An object is launched upward at 64 feet per second from a platform 80 feet above the ground. The function $s(t)$ models the height of the object t seconds after launch.

If $s(t) = -16t^2 + 64t + 80$, state the vertex of $s(t)$, and explain in detail what each coordinate means in the context of the problem.

$(2, 144)$ At 2 seconds, the object is 144 ft above ground.

After the object is launched, how many seconds does it take for the object to hit the ground? Justify your answer.

$$-16t^2 + 64t + 80 = 0$$
$$t^2 - 4t - 5 = 0$$
$$(t-5)(t+1) = 0$$
$$t = 5$$

34 Solve the system of equations algebraically for all values of x and y.

$$y = x^2 + 4x - 1$$
$$y = 2x + 7$$

$x^2 + 4x - 1 = 2x + 7$

$x^2 + 2x - 8 = 0$

$(x+4)(x-2) = 0$

$x = -4, 2$

$y = 2(-4) + 7 = -1$

$y = 2(2) + 7 = 11$

$(-4, -1) \quad (2, 11)$

Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided to determine your answer. Note that diagrams are not necessarily drawn to scale. A correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [6]

35 Jen joined the Fan Favorite Movie Club at the local movie theater. At this theater, the cost of admission in May and June remains the same. In May, she saw 2 matinees and 3 regular-priced shows and spent $38.50. In June, she went to 6 matinees and one regular-priced show and spent $47.50.

Write a system of equations to represent the cost, m, of a matinee ticket and the cost, r, of a regular-priced ticket.

$$2m + 3r = 38.5$$
$$6m + r = 47.5$$

Jen said she spent $5.75 on each matinee and $9 on each regular show. Is Jen correct? Justify your answer.

$$No$$

Use your system of equations to algebraically determine both the actual cost of each matinee ticket and the actual cost of each regular ticket.

$$6m + 9r = 115.5$$
$$\underline{6m + r = 47.5}$$
$$8r = 68$$
$$r = 8.50$$

$$2m + 3(8.5) = 38.5$$
$$2m + 25.5 = 38.5$$
$$2m = 13$$
$$m = 6.50$$