

# INTEGRATED ALGEBRA

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

# INTEGRATED ALGEBRA

Thursday, June 18, 2015 — 9:15 a.m. to 12:15 p.m., only

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School Name: JMAP.ORG

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 39 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 graphs and drawings, which should be done in pencil. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. 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 30 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  $A = \{1,2,3,4,5,6,7,8\}$  and  $B = \{2,4,6,8,10,12\}$ , then the intersection of these two sets is

Use this space for computations.

- (1)  $\{10,12\}$                         $\{2,4,6,8\}$   
 (2)  $\{1,3,5,7\}$                       (4)  $\{1,2,3,4,5,6,7,8,10,12\}$

2 There are 4 students running for Student Government President. A survey was taken asking 100 students which candidate they would vote for in the election. The results are shown in the table below:

Candidate's Name	Number of Supporters
Ashley	30
Britney	28
Lyshon	14
Walker	28

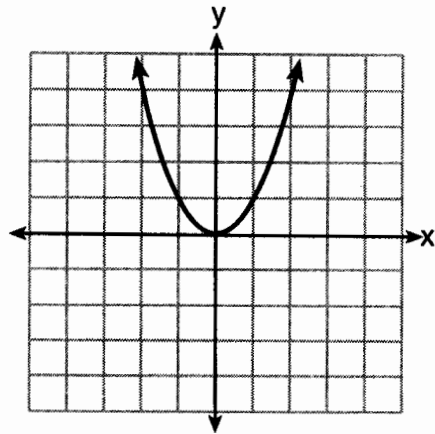
$$\frac{14}{100} = \frac{7}{50}$$

Based on the table, what is the probability that a student chosen at random will vote for Lyshon?

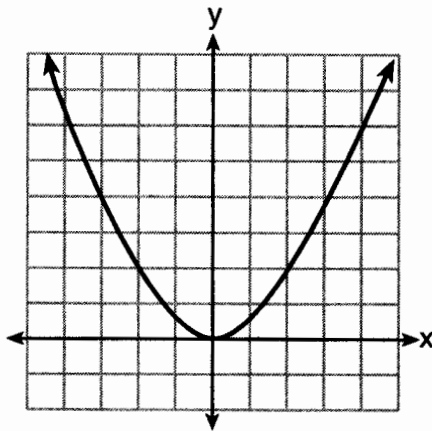
- (1)  $\frac{3}{10}$                         $\frac{7}{50}$   
 (2)  $\frac{7}{25}$                       (4)  $\frac{43}{50}$

3 The graph of  $y = x^2$  is shown below.

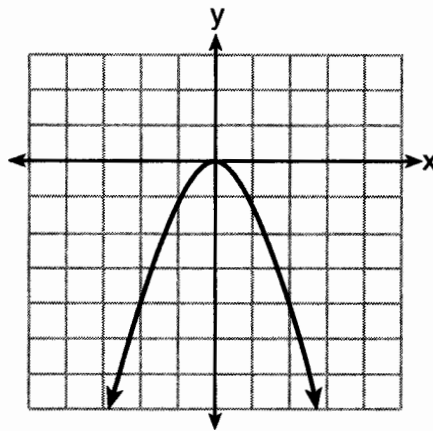
Use this space for computations.



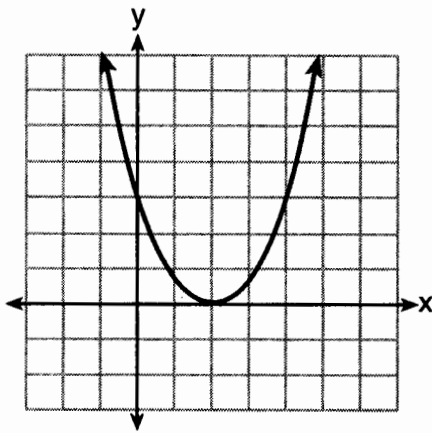
Which graph represents  $y = 2x^2$ ?



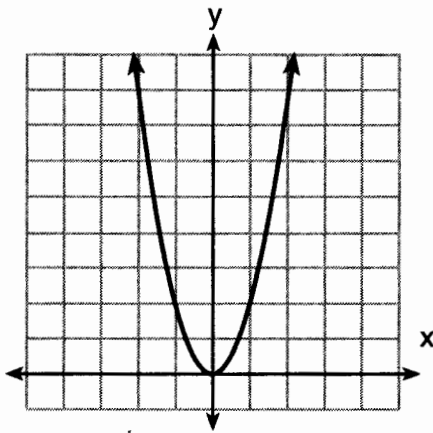
(1)



(3)



(2)



(4)

Use this space for computations.

4 The local deli charges a fee for delivery. On Monday, they delivered two dozen bagels to an office at a total cost of \$8. On Tuesday, three dozen bagels were delivered at a total cost of \$11. Which system of equations could be used to find the cost of a dozen bagels,  $b$ , if the delivery fee is  $f$ ?

(1)  $b + 2f = 8$   
 $b + 3f = 11$

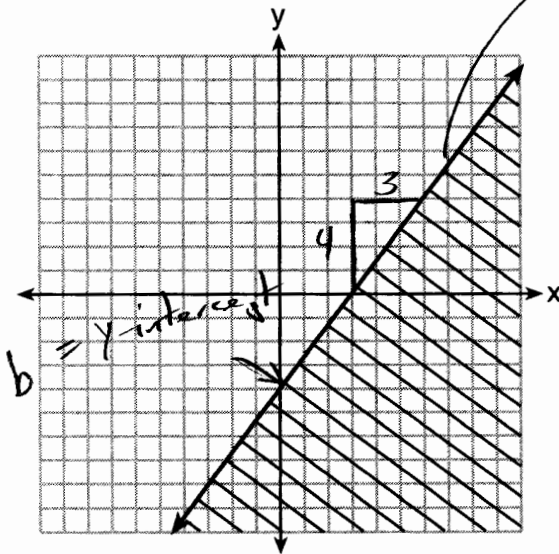
(3)  $b + 2f = 8$   
 $3b + f = 11$

(2)  $2b + f = 8$   
 $b + 3f = 11$

(4)  $2b + f = 8$   
 $3b + f = 11$

$2b + f = 8$   
 $3b + f = 11$

5 Which inequality is shown in the graph below?



solid line  $\leq$   
 $b = -4$

$y = mx + b$

$y \leq \frac{4}{3}x - 4$

$m = \frac{\text{rise}}{\text{run}} = \frac{4}{3}$

(1)  $y \leq \frac{4}{3}x + 3$

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

(3)  $y \geq \frac{4}{3}x + 3$

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

6 Which expression is equivalent to  $81 - 16x^2$ ?

(1)  $(9 - 8x)(9 + 8x)$

(2)  $(9 - 4x)(9 + 4x)$

(3)  $(9 - 8x)(9 + 2x)$

(4)  $(9 - 4x)(9 - 4x)$

$(a^2 - b^2) = (a+b)(a-b)$   
 $81 - 16x^2 = (9 + 4x)(9 - 4x)$

Use this space for computations.

7 Which value of  $x$  is the solution of  $\frac{1}{5} + \frac{2}{x} = \frac{1}{3}$ ?

- (1)  $-2\frac{3}{4}$  (3)  $2\frac{3}{4}$   
 (2)  $-15$  (4)  $15$

$$5 \left( \frac{1}{5} + \frac{2}{x} = \frac{1}{3} \right)$$

$$3 \left( 1 + \frac{10}{x} = \frac{5}{3} \right)$$

$$x \left( 3 + \frac{30}{x} = 5 \right)$$

$$3x + 30 = 5x$$

$$30 = 2x$$

$$15 = x$$

$$\left( \frac{x}{x} \right) \frac{1}{5} + \frac{2}{x} \left( \frac{5}{5} \right) = \frac{1}{3}$$

$$\frac{x}{5x} + \frac{10}{5x} = \frac{1}{3}$$

$$\frac{x+10}{5x} = \frac{1}{3}$$

$$3x+30 = 5x$$

8 The product of a number and 3, increased by 5, is 7 less than twice the number. Which equation can be used to find this number,  $n$ ?

- (1)  $3n + 5 = 2n - 7$  (3)  $3(n + 5) = 2n - 7$   
 (2)  $3n + 5 = 7 - 2n$  (4)  $3(n + 5) = 7 - 2n$

$$3n + 5 = 2n - 7$$

9 Which linear equation represents a line that has a slope of  $\frac{2}{3}$ ?

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

$$y = \frac{-2}{3}x$$

$$y = \frac{2}{3}x$$

two variables

10 Which situation is an example of bivariate data?

- (1) shoe sizes of a tennis team  
 (2) goals scored in soccer games  
 (3) Calories consumed in one day  
 (4) hours studying compared to test scores

11 What is the solution of the following system of equations?

$$2a + 3b = 12$$

$$a = \frac{1}{2}b - 6$$

- (1)  $a = -6$  and  $b = 0$  (3)  $a = -3$  and  $b = 6$   
 (2)  $a = -4.5$  and  $b = 3$  (4)  $a = 24$  and  $b = 6$

$$2a + 3b = 12$$

$$2 \left( \frac{1}{2}b - 6 \right) + 3b = 12$$

$$b - 12 + 3b = 12$$

$$4b = 24$$

$$b = 6$$

$$a = \frac{1}{2}b - 6$$

$$a = \frac{1}{2}(6) - 6$$

$$a = 3 - 6$$

$$a = -3$$

Use this space for computations.

12 Which statement is true about the data shown in the scatter plot below?



- (1) There is no correlation between the two sets of data.
- (2) There is a positive correlation between the two sets of data.
- (3) There is a negative correlation between the two sets of data.
- (4) The correlation between the data is both positive and negative.

13 The graph of the equation  $y = -2$  is a line

- (1) parallel to the  $x$ -axis
- (2) parallel to the  $y$ -axis
- (3) passing through the origin
- (4) passing through the point  $(-2, 0)$

14 The base of a closed right circular cylinder has a diameter of 5 cm. If the height of the cylinder is 8 cm, what is the surface area of the cylinder, to the nearest square centimeter?

- (1) 157
- (2) 165
- (3) 408
- (4) 628

$$A = \pi r^2$$

$$A = \pi (2.5)^2$$

$$A = 6.25\pi$$

$$2A = 12.5\pi$$



$$C = \pi d$$

$$C = 5\pi$$

$$S.A. side = 8(5\pi)$$

15 Which equation represents the line that passes through the points  $(-1, -2)$  and  $(3, 10)$ ?

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

$$m = \frac{10 - (-2)}{3 - (-1)} = \frac{12}{4} = 3$$

$$\frac{12.5\pi}{40\pi} = 52.5\pi \approx 164.93$$

Check in graphing calculator

x	y
-1	-2 ✓
0	1
1	4
2	7
3	10 ✓

$$y = mx + b$$

$$10 = 3(3) + b$$

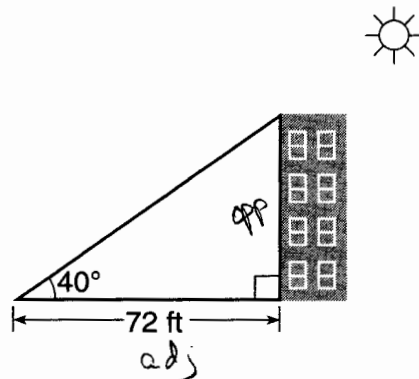
$$10 = 9 + b$$

$$1 = b$$

$$y = 3x + 1$$

Use this space for computations.

- 16 As shown in the diagram below, a building casts a 72-foot shadow on the ground when the angle of elevation of the Sun is  $40^\circ$ .



$$\tan 40^\circ = \frac{\text{opp}}{\text{adj}} = \frac{\text{opp}}{72}$$

$$72 \tan 40^\circ = \text{opp}$$

$$60.415 = \text{opp}$$

How tall is the building, to the nearest foot?

- (1) 46                                      (3) 86  
 (2) 60                                      (4) 94
- 17 Which value of  $x$  is a solution of the inequality  $25x - 100 < 250$ ?

- (1) 13                                      (3) 15  
 (2) 14                                      (4) 16

$$25x - 100 < 250$$

$$25x < 250 + 100$$

$$25x < 350$$

$$x < \frac{350}{25}$$

$$x < 14$$

- 18 The square of a positive number is 24 more than 5 times the number. What is the value of the number?

- (1) 6                                      (3) 3  
 (2) 8                                      (4) 4

$$n^2 = 5n + 24$$

$$n^2 - 5n - 24 = 0$$

$$(n - 8)(n + 3) = 0$$


---


$$n - 8 = 0 \quad | \quad n + 3 = 0$$

$$n = 8 \quad \quad \quad n = -3$$

Check

$$8^2 = 5(8) + 24$$

$$64 = 40 + 24$$

$$64 = 64 \checkmark$$

- 19 Owino gets paid \$280 per week plus 5% commission on all sales for selling electronic equipment. If he sells  $n$  dollars worth of electronic equipment in one week, which algebraic expression represents the amount of money he will earn that week?

- (1)  $280n + 5$                                        (3)  $280 + 0.05n$   
 (2)  $280n + 0.05$                                       (4)  $280 + 5n$

$$5\% = .05$$

$$280 + .05n$$

undefined means dividing by zero.

Use this space for computations.

20 Which value of  $x$  makes the expression  $\frac{x+9}{3x-6}$  undefined?

- (1) -9  
● 2  
(3) -3  
(4) 0

$$\begin{aligned} 3x - 6 &= 0 \\ 3x &= 6 \\ x &= 2 \end{aligned}$$

21 A total of 1680 ounces of pet food have to be packed in 5-pound bags. How many 5-pound bags of pet food can be packed?

1 pound = 16 ounces

$$5 \times 16 = 80 \text{ ounces}$$

- 21  
(2) 28  
(3) 105  
(4) 336

$$\frac{1680}{80} = 21$$

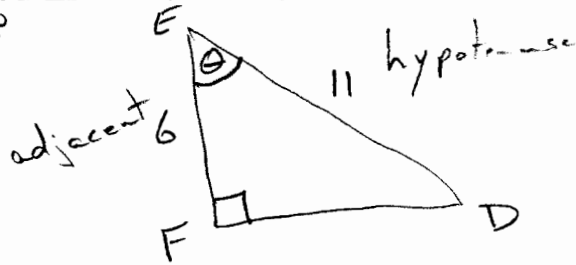
22 For a class of students, which data set could be classified as qualitative?

- political opinions  
(2) heights  
(3) weights  
(4) ages

23 In right triangle  $EFD$ ,  $ED = 11$ ,  $EF = 6$ , and  $m\angle F = 90$ . What is the measure of angle  $E$ , to the nearest degree?

- (1) 61  
● 57  
(3) 33  
(4) 29

$$\begin{aligned} \cos E &= \frac{\text{adj}}{\text{hyp}} = \frac{6}{11} \\ \arccos \frac{6}{11} &= 56.94^\circ \end{aligned}$$



24 If  $z + y = x + xy^2$ , what is  $x$  expressed in terms of  $y$  and  $z$ ?

- (1)  $\frac{z}{y}$   
(2)  $\frac{z}{1+y}$   
(3)  $\frac{z+1}{y}$   
●  $\frac{z+y}{1+y^2}$

$$\frac{z+y}{x} = \frac{x + xy^2}{x}$$

$$\frac{z+y}{x} = 1 + y^2$$

$$\frac{z+y}{1+y^2} = x$$





Use this space for  
computations.

29 The set of integers in  $[6,10)$  can be written as

- (1)  $\{6, 7, 8, 9, 10\}$                         $\{6, 7, 8, 9\}$   
(2)  $\{7, 8, 9, 10\}$                       (4)  $\{7, 8, 9\}$

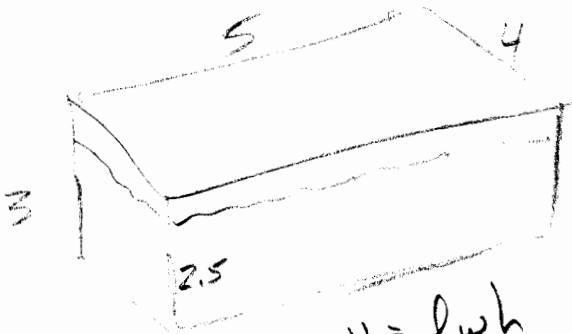
$$6 \leq x < 10$$

$$6 \ 7 \ 8 \ 9$$

30 A rectangular tank measures 5 feet long, 4 feet wide, and 3 feet high.

Water is poured into the tank to a depth of  $2\frac{1}{2}$  feet. How many cubic feet of water are in the tank?

- (1) 60                                      (3) 15.5  
 50                                      (4) 11.5
- 



$$\begin{aligned} V &= lwh \\ V &= 5 \times 4 \times 2.5 \\ V &= 20 \times 2.5 \\ V &= 50 \end{aligned}$$

Part II

Answer all 3 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. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [6]

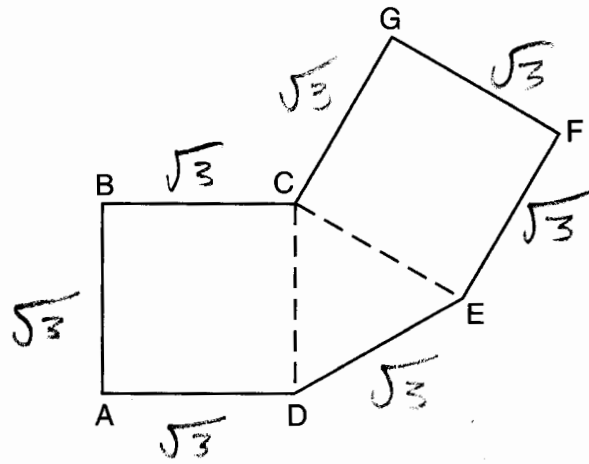
31 Jen traveled a distance of 170 miles in 2 hours and 45 minutes. Express her speed, in miles per hour, to the nearest tenth.

$$\text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{170 \text{ miles}}{2\frac{3}{4} \text{ hours}}$$

$$\frac{170 \text{ miles}}{2.75 \text{ hours}}$$

$$61.8 \text{ mph}$$

32 As shown below, polygon  $ABCGFED$  consists of two squares,  $ABCD$  and  $CGFE$ , and an equilateral triangle  $CED$ . The length of  $\overline{BC}$  is  $\sqrt{3}$  cm. Determine the perimeter of polygon  $ABCGFED$  in radical form.



$$7\sqrt{3}$$

33 Write a quadratic equation in standard form that has roots of  $-12$  and  $2$ .

$$x = -12$$

$$x = 2$$

$$x + 12 = 0$$

$$x - 2 = 0$$

$$(x + 12)(x - 2) = 0$$

$$x^2 - 2x + 12x - 24 = 0$$

$$x^2 + 10x - 24 = 0$$

$$f(x) = x^2 + 10x - 24$$

Part III

Answer all 3 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. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [9]

- 34 Find algebraically the equation of the axis of symmetry and the vertex of the parabola represented by the equation  $y = -x^2 - 2x + 1$ .

$$\text{axis} = \frac{-b}{2a} = \frac{-(-2)}{2(-1)} = \frac{2}{-2} = -1$$

axis of symmetry  $\boxed{x = -1}$

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

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

$$y = -1 + 2 + 1$$

$$y = 2$$

$\boxed{\text{Vertex} = (-1, 2)}$

Check in graphing calculator

x	y
-3	-2
-2	1
-1	2
0	1
1	-2
2	-7

- 35 Linda measures her rectangular bedroom window for a new shade. The measurements she made are 36 inches by 42 inches. The actual measurements of the window are 36.5 inches and 42.5 inches. Determine the relative error in calculating the area. Express your answer as a decimal to the nearest thousandth.

$$\text{Relative Error} = \left| \frac{\text{Actual} - \text{Measured}}{\text{Actual}} \right|$$

$$\left| \frac{(36)(42) - (36.5)(42.5)}{(36.5)(42.5)} \right|$$

$$\left| \frac{-39.25}{1551.25} \right|$$

$$.0253021757$$

$$\boxed{.025}$$

36 The following set of data represents the heights, in inches, of the 20 students in Ms. Fitzgerald's freshman class:

~~63~~, ~~56~~, ~~67~~, ~~59~~, ~~70~~, ~~69~~, ~~62~~, ~~74~~, ~~66~~, ~~72~~  
~~67~~, ~~60~~, ~~70~~, ~~66~~, ~~67~~, ~~58~~, ~~68~~, ~~72~~, ~~63~~, ~~67~~

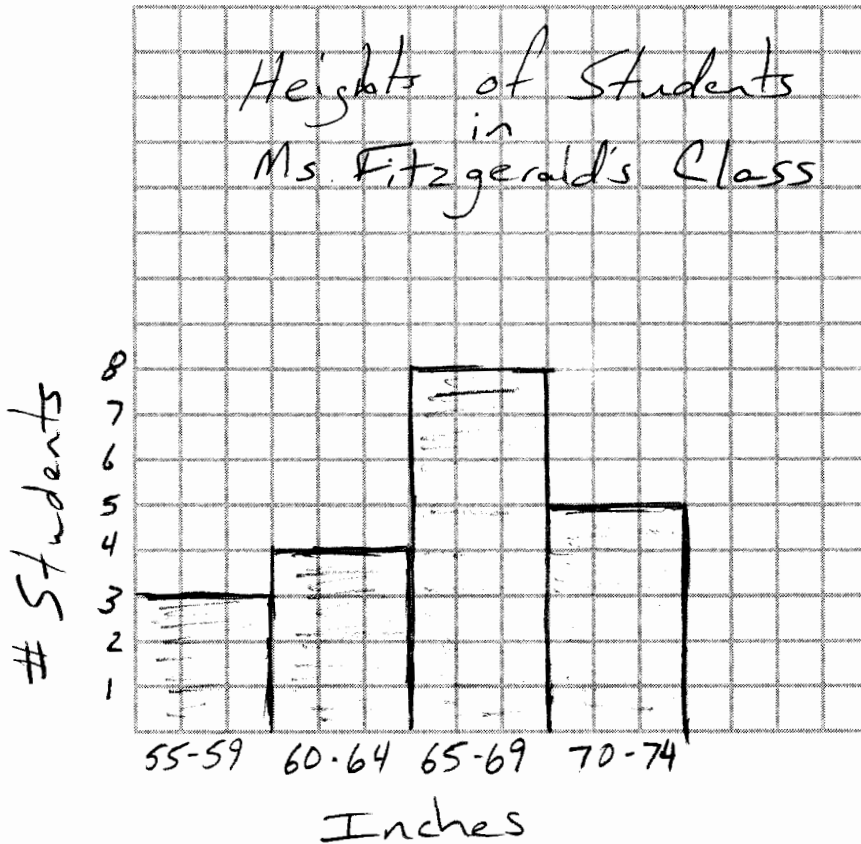
Complete the frequency table below.

Heights of Students

Interval	Tally	Frequency
55-59		3
60-64		4
65-69		6
70-74		5

20

On the grid below, draw and label a frequency histogram for these data.





Part IV

Answer all 3 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. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [12]

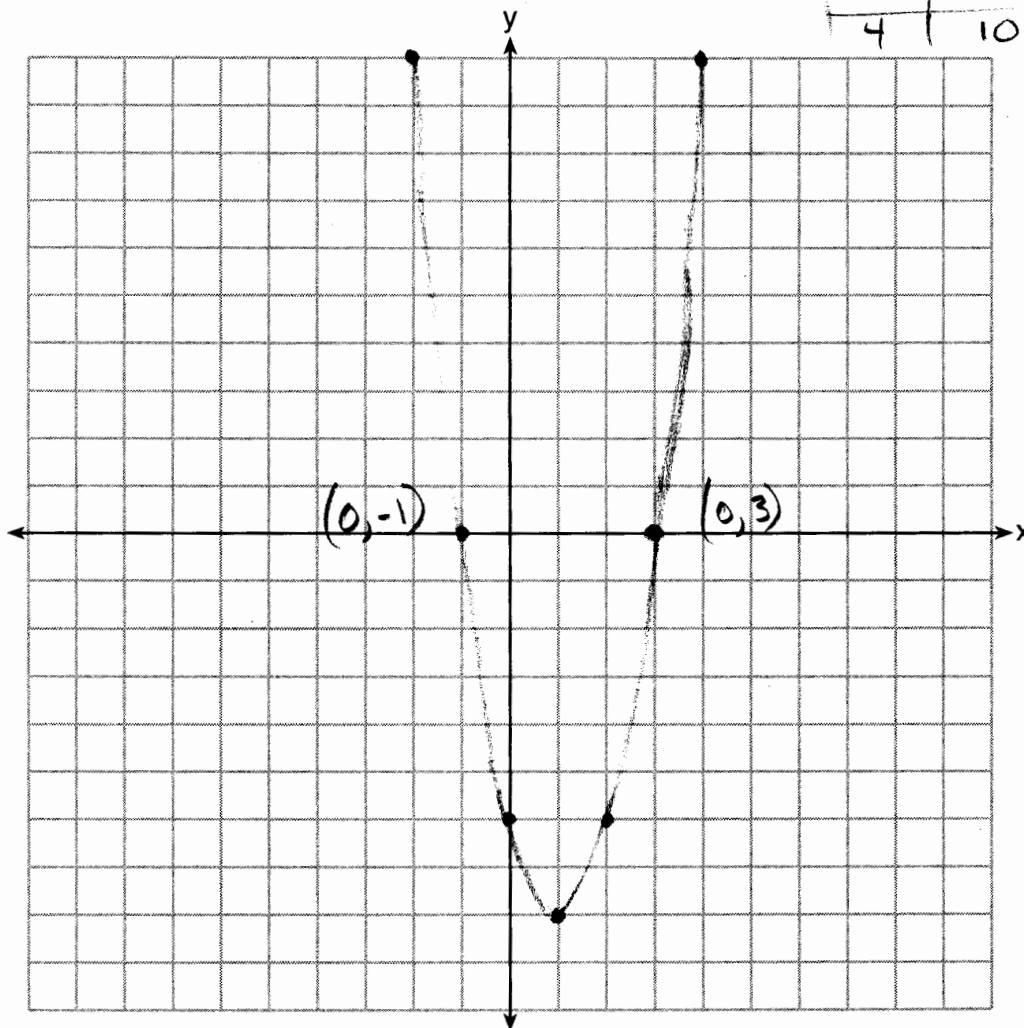
37 On the set of axes below, graph  $y = 2x^2 - 4x - 6$ .

State the roots of  $0 = 2x^2 - 4x - 6$ .

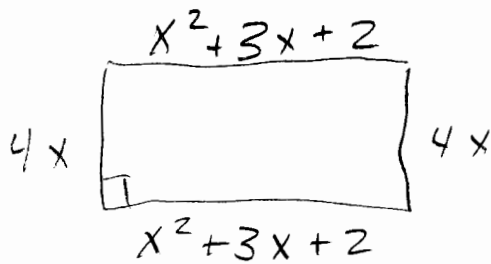
Roots are

-1 and 3

x	y
-2	10
-1	0
0	-6
1	-8
2	-6
3	0
4	10



- 38 The length of a rectangle is represented by  $x^2 + 3x + 2$ , and the width is represented by  $4x$ .  
Express the perimeter of the rectangle as a trinomial.



$$P = 2l + 2w$$

$$x^2 + 3x + 2$$

$$x^2 + 3x + 2$$

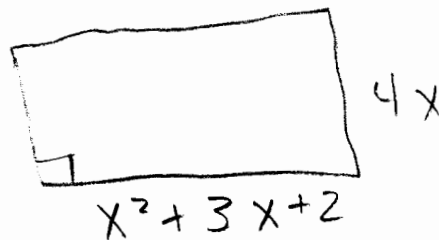
$$4x$$

$$4x$$

Answer

$$2x^2 + 14x + 4$$

Express the area of the rectangle as a trinomial.



$$A = lw$$

$$A = (x^2 + 3x + 2) 4x$$

Answer

$$A = 4x^3 + 12x^2 + 8x$$

39 Tony makes a phone call at a pay phone. The charge is 25 cents for the first four minutes, and 10 cents for each additional minute. Tony has \$2.10 in change in his pocket. Write an inequality that can be used to find  $m$ , the maximum number of minutes that Tony can talk on the phone.

$$2.10 \geq .25 + .10(m-4)$$

Solve this inequality algebraically to find the maximum number of whole minutes he can talk on the phone.

$$2.1 \geq .25 + .1(m-4)$$

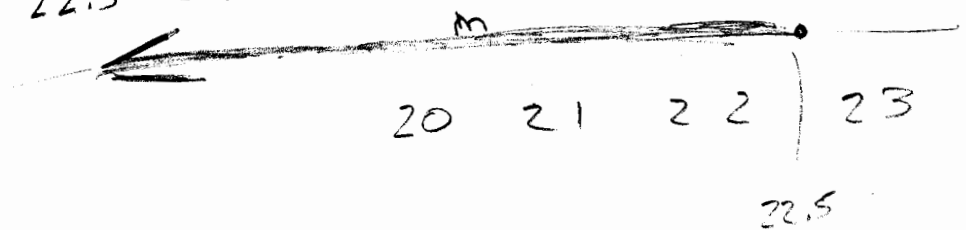
$$2.1 \geq .25 + .1m - .4$$

$$m_{10} \quad 21 \geq 2.5 + m - 4$$

$$21 \geq -1.5 + m$$

$$21 + 1.5 \geq m$$

$$22.5 \geq m$$



22 minutes