

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

# MATHEMATICS B

Wednesday, August 13, 2003 — 8:30 to 11:30 a.m., only

Print Your Name:

Print Your School's Name:

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. Write all your work in pen, except graphs and drawings, which should be done in pencil.

This examination has four parts, with a total of 34 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. The formulas that you may need to answer some questions in this examination are found on page 19.

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, 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.**





Use this space for computations.

7 Which expression is equal to  $\frac{2+\sqrt{3}}{2-\sqrt{3}}$ ?

(1)  $\frac{1-4\sqrt{3}}{7}$

(3)  $1 - 4\sqrt{3}$

(2)  $\frac{7+4\sqrt{3}}{7}$

(4)  $7 + 4\sqrt{3}$

8 Which transformation is *not* an isometry?

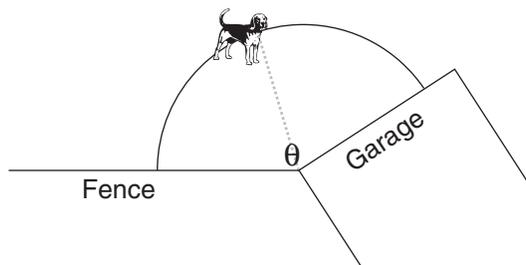
(1) rotation

(3) dilation

(2) line reflection

(4) translation

9 A dog has a 20-foot leash attached to the corner where a garage and a fence meet, as shown in the accompanying diagram. When the dog pulls the leash tight and walks from the fence to the garage, the arc the leash makes is 55.8 feet.



(Not drawn to scale)

What is the measure of angle  $\theta$  between the garage and the fence, in radians?

(1) 0.36

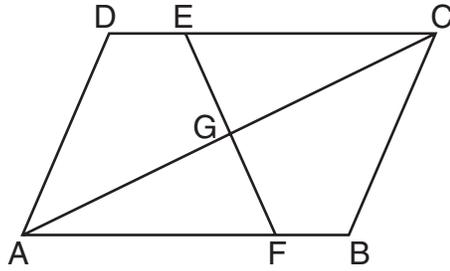
(3) 3.14

(2) 2.79

(4) 160

- 10 In the accompanying diagram of parallelogram  $ABCD$ ,  $\overline{DE} \cong \overline{BF}$ .

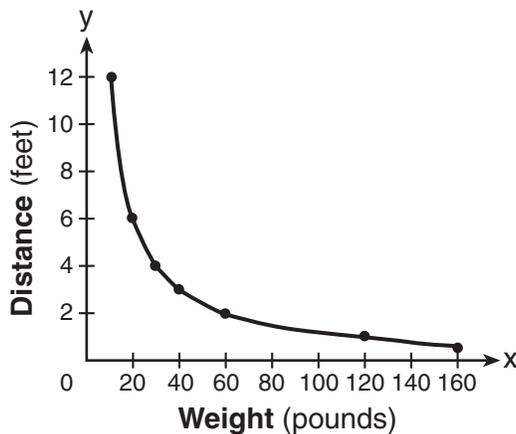
Use this space for computations.



Triangle  $EGC$  can be proved congruent to triangle  $FGA$  by

- |                     |                     |
|---------------------|---------------------|
| (1) HL $\cong$ HL   | (3) AAS $\cong$ AAS |
| (2) AAA $\cong$ AAA | (4) SSA $\cong$ SSA |
- 11 An architect commissions a contractor to produce a triangular window. The architect describes the window as  $\triangle ABC$ , where  $m\angle A = 50$ ,  $BC = 10$  inches, and  $AB = 12$  inches. How many distinct triangles can the contractor construct using these dimensions?
- |       |                 |
|-------|-----------------|
| (1) 1 | (3) more than 2 |
| (2) 2 | (4) 0           |

- 12 The accompanying graph shows the relationship between a person's weight and the distance that the person must sit from the center of a seesaw to make it balanced.



Which equation best represents this graph?

- |                 |                         |
|-----------------|-------------------------|
| (1) $y = 12x^2$ | (3) $y = 2 \log x$      |
| (2) $y = -120x$ | (4) $y = \frac{120}{x}$ |

Use this space for computations.

13 If  $f$  and  $g$  are two functions defined by  $f(x) = 3x + 5$  and  $g(x) = x^2 + 1$ , then  $g(f(x))$  is

- (1)  $x^2 + 3x + 6$                       (3)  $3x^2 + 8$   
(2)  $9x^2 + 30x + 26$                 (4)  $9x^2 + 26$

14 What is the product of  $5 + \sqrt{-36}$  and  $1 - \sqrt{-49}$ , expressed in simplest  $a + bi$  form?

- (1)  $-37 + 41i$                           (3)  $47 + 41i$   
(2)  $5 - 71i$                               (4)  $47 - 29i$

15 The expression  $\frac{2 \cos \theta}{\sin 2\theta}$  is equivalent to

- (1)  $\csc \theta$                                 (3)  $\cot \theta$   
(2)  $\sec \theta$                                 (4)  $\sin \theta$

16 If  $\sin x = \frac{12}{13}$ ,  $\cos y = \frac{3}{5}$ , and  $x$  and  $y$  are acute angles, the value of  $\cos(x - y)$  is

- (1)  $\frac{21}{65}$                                     (3)  $-\frac{14}{65}$   
(2)  $\frac{63}{65}$                                     (4)  $-\frac{33}{65}$

17 The amount of ketchup dispensed from a machine at Hamburger Palace is normally distributed with a mean of 0.9 ounce and a standard deviation of 0.1 ounce. If the machine is used 500 times, approximately how many times will it be expected to dispense 1 or more ounces of ketchup?

- (1) 5                                         (3) 80  
(2) 16                                        (4) 100

**Use this space for  
computations.**

**18** A commercial artist plans to include an ellipse in a design and wants the length of the horizontal axis to equal 10 and the length of the vertical axis to equal 6. Which equation could represent this ellipse?

- (1)  $9x^2 + 25y^2 = 225$       (3)  $x^2 + y^2 = 100$   
(2)  $9x^2 - 25y^2 = 225$       (4)  $3y = 20x^2$

**19** A function is defined by the equation  $y = \frac{1}{2}x - \frac{3}{2}$ . Which equation defines the inverse of this function?

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

**20** In the equation  $ax^2 + 6x - 9 = 0$ , imaginary roots will be generated if

- (1)  $-1 < a < 1$       (3)  $a > -1$ , only  
(2)  $a < 1$ , only      (4)  $a < -1$
-

## 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. [12]

- 21 The height,  $h$ , in feet, a ball will reach when thrown in the air is a function of time,  $t$ , in seconds, given by the equation  $h(t) = -16t^2 + 30t + 6$ . Find, to the *nearest tenth*, the maximum height, in feet, the ball will reach.

- 22 Find the value of  $(x + 2)^0 + (x + 1)^{-\frac{2}{3}}$  when  $x = 7$ .

**23** Express in simplest form:  $\frac{\frac{x}{4} - \frac{4}{x}}{1 - \frac{4}{x}}$

**24** The triangular top of a table has two sides of 14 inches and 16 inches, and the angle between the sides is  $30^\circ$ . Find the area of the tabletop, in square inches.

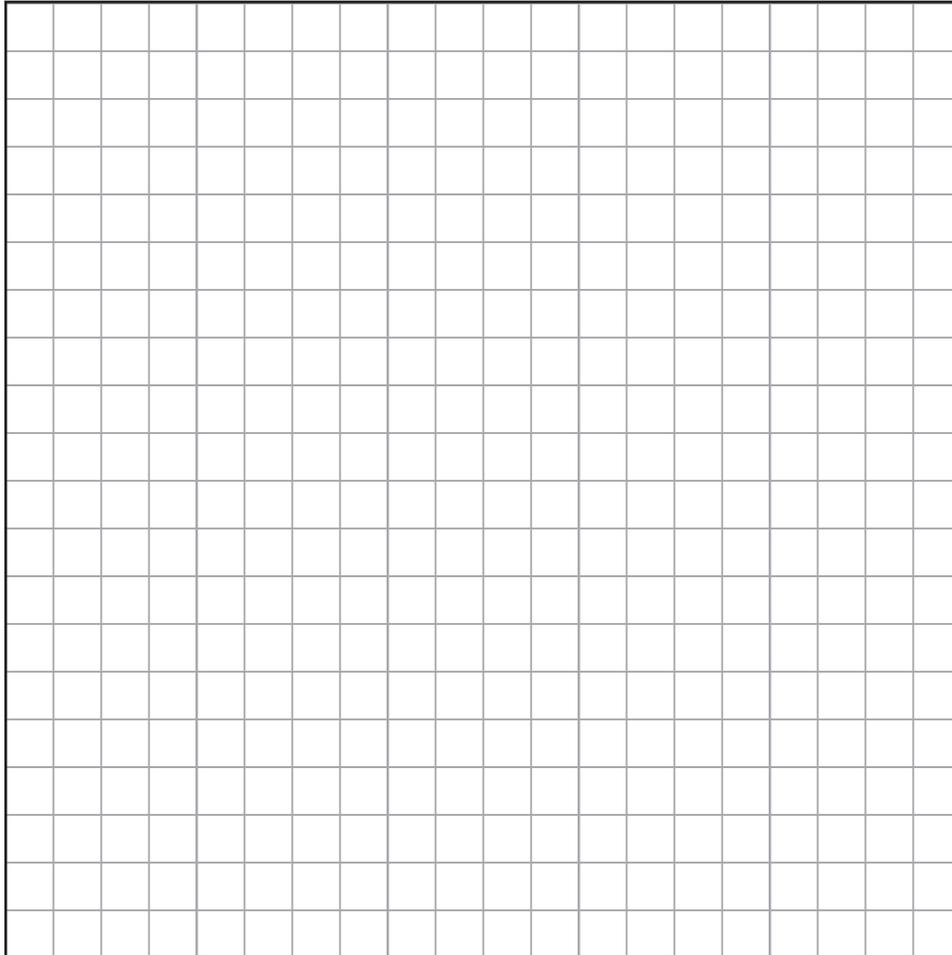
**25** Meteorologists can determine how long a storm lasts by using the function  $t(d) = 0.07d^{\frac{3}{2}}$ , where  $d$  is the diameter of the storm, in miles, and  $t$  is the time, in hours. If the storm lasts 4.75 hours, find its diameter, to the *nearest tenth of a mile*.

**26** Tom scored 23 points in a basketball game. He attempted 15 field goals and 6 free throws. If each successful field goal is 2 points and each successful free throw is 1 point, is it possible he successfully made all 6 of his free throws? Justify your answer.

### Part III

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. [24]

27 On the accompanying grid, graph and label  $\overline{AB}$ , where  $A$  is  $(0,5)$  and  $B$  is  $(2,0)$ . Under the transformation  $r_{x\text{-axis}} \circ r_{y\text{-axis}}(\overline{AB})$ ,  $A$  maps to  $A''$ , and  $B$  maps to  $B''$ . Graph and label  $\overline{A''B''}$ . What single transformation would map  $\overline{AB}$  to  $\overline{A''B''}$ ?



**28** Express, in simplest  $a + bi$  form, the roots of the equation  $x^2 + 5 = 4x$ .

**29** A ship at sea is 70 miles from one radio transmitter and 130 miles from another. The angle between the signals sent to the ship by the transmitters is  $117.4^\circ$ . Find the distance between the two transmitters, to the *nearest mile*.

- 30** A student attaches one end of a rope to a wall at a fixed point 3 feet above the ground, as shown in the accompanying diagram, and moves the other end of the rope up and down, producing a wave described by the equation  $y = a \sin bx + c$ . The range of the rope's height above the ground is between 1 and 5 feet. The period of the wave is  $4\pi$ . Write the equation that represents this wave.



- 31 The table below shows the results of an experiment that relates the height at which a ball is dropped,  $x$ , to the height of its first bounce,  $y$ .

Drop Height ( $x$ ) (cm)	Bounce Height ( $y$ ) (cm)
100	26
90	23
80	21
70	18
60	16

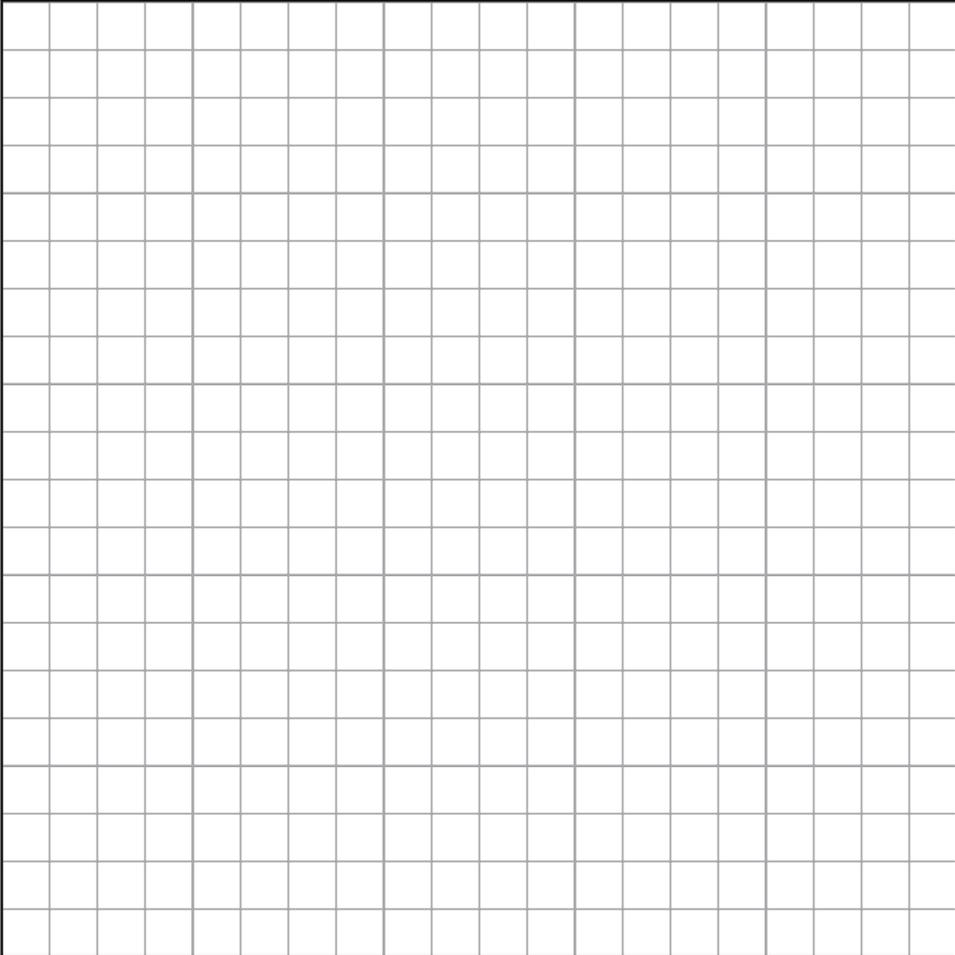
Find  $\bar{x}$ , the mean of the drop heights.

Find  $\bar{y}$ , the mean of the bounce heights.

Find the linear regression equation that best fits the data.

Show that  $(\bar{x}, \bar{y})$  is a point on the line of regression. [The use of the grid on the next page is optional.]

**Question 31 continued**



**32** A company calculates its profit by finding the difference between revenue and cost. The cost function of producing  $x$  hammers is  $C(x) = 4x + 170$ . If each hammer is sold for \$10, the revenue function for selling  $x$  hammers is  $R(x) = 10x$ .

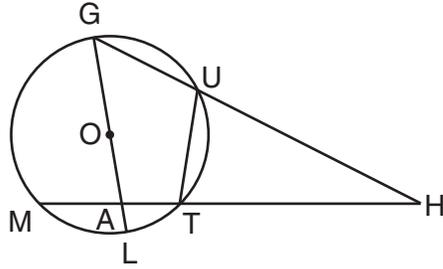
How many hammers must be sold to make a profit?

How many hammers must be sold to make a profit of \$100?

Part IV

Answer all questions in this part. Each correct answer will receive 6 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. [12]

- 33 Given circle  $O$  with diameter  $\overline{GOAL}$ ; secants  $\overline{HUG}$  and  $\overline{HTAM}$  intersect at point  $H$ ;  $m\widehat{GM}:m\widehat{ML}:m\widehat{LT} = 7:3:2$ ; and chord  $\overline{GU} \cong$  chord  $\overline{UT}$ . Find the ratio of  $m\angle UGL$  to  $m\angle H$ .



**34** When Joe bowls, he can get a strike (knock down all the pins) 60% of the time. How many times more likely is it for Joe to bowl *at least* three strikes out of four tries as it is for him to bowl zero strikes out of four tries? Round your answer to the *nearest whole number*.

# Formulas

## Area of Triangle

$$K = \frac{1}{2} ab \sin C$$

## Law of Cosines

$$a^2 = b^2 + c^2 - 2bc \cos A$$

## Functions of the Sum of Two Angles

$$\begin{aligned} \sin(A + B) &= \sin A \cos B + \cos A \sin B \\ \cos(A + B) &= \cos A \cos B - \sin A \sin B \end{aligned}$$

## Functions of the Double Angle

$$\begin{aligned} \sin 2A &= 2 \sin A \cos A \\ \cos 2A &= \cos^2 A - \sin^2 A \\ \cos 2A &= 2 \cos^2 A - 1 \\ \cos 2A &= 1 - 2 \sin^2 A \end{aligned}$$

## Functions of the Difference of Two Angles

$$\begin{aligned} \sin(A - B) &= \sin A \cos B - \cos A \sin B \\ \cos(A - B) &= \cos A \cos B + \sin A \sin B \end{aligned}$$

## Functions of the Half Angle

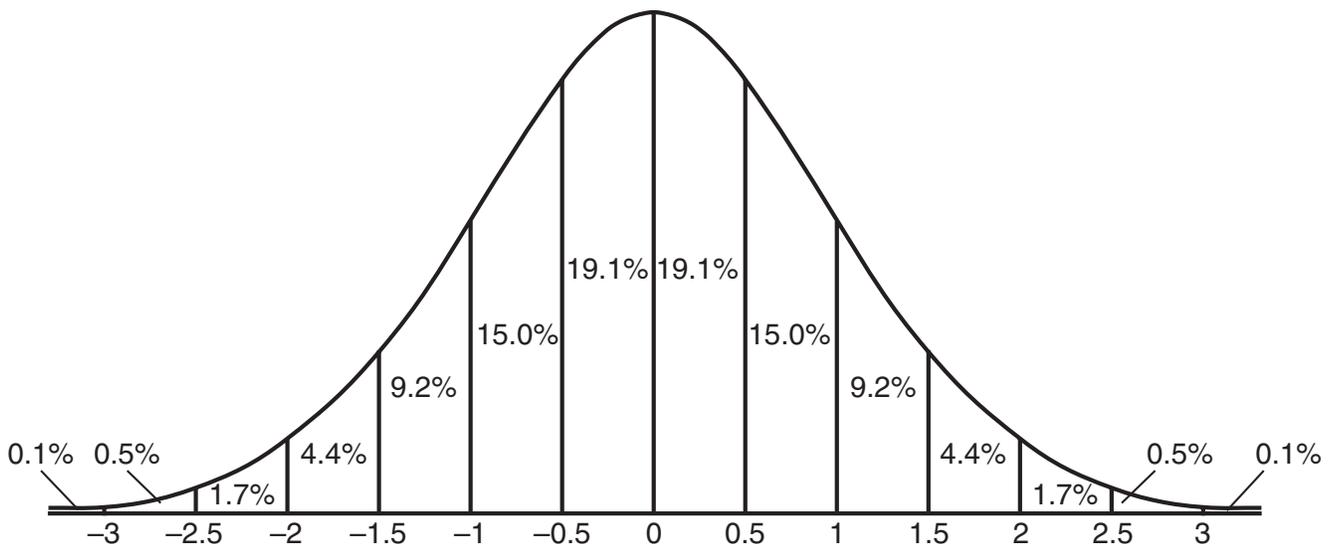
$$\begin{aligned} \sin \frac{1}{2} A &= \pm \sqrt{\frac{1 - \cos A}{2}} \\ \cos \frac{1}{2} A &= \pm \sqrt{\frac{1 + \cos A}{2}} \end{aligned}$$

## Law of Sines

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

## Normal Curve

### Standard Deviation

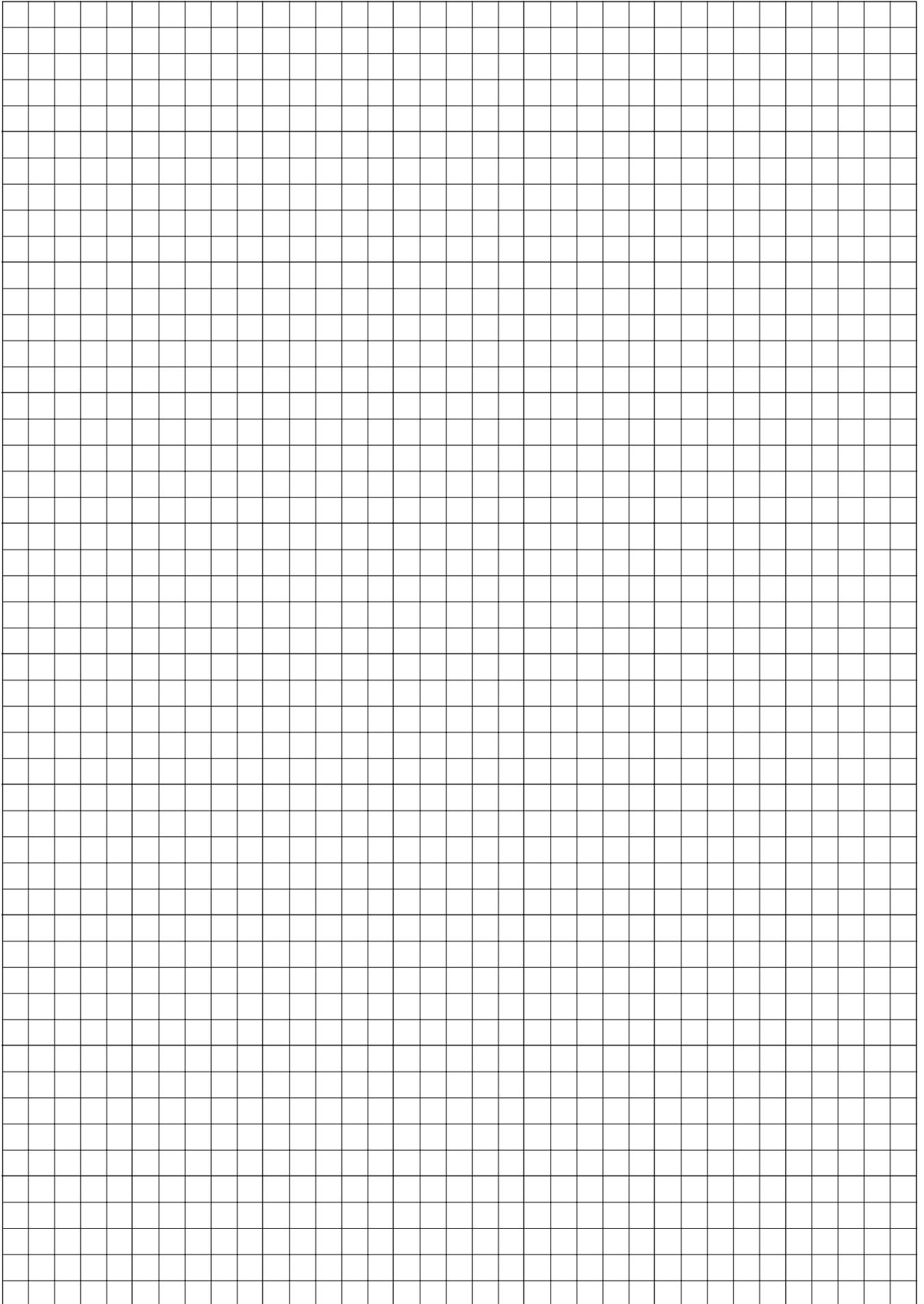




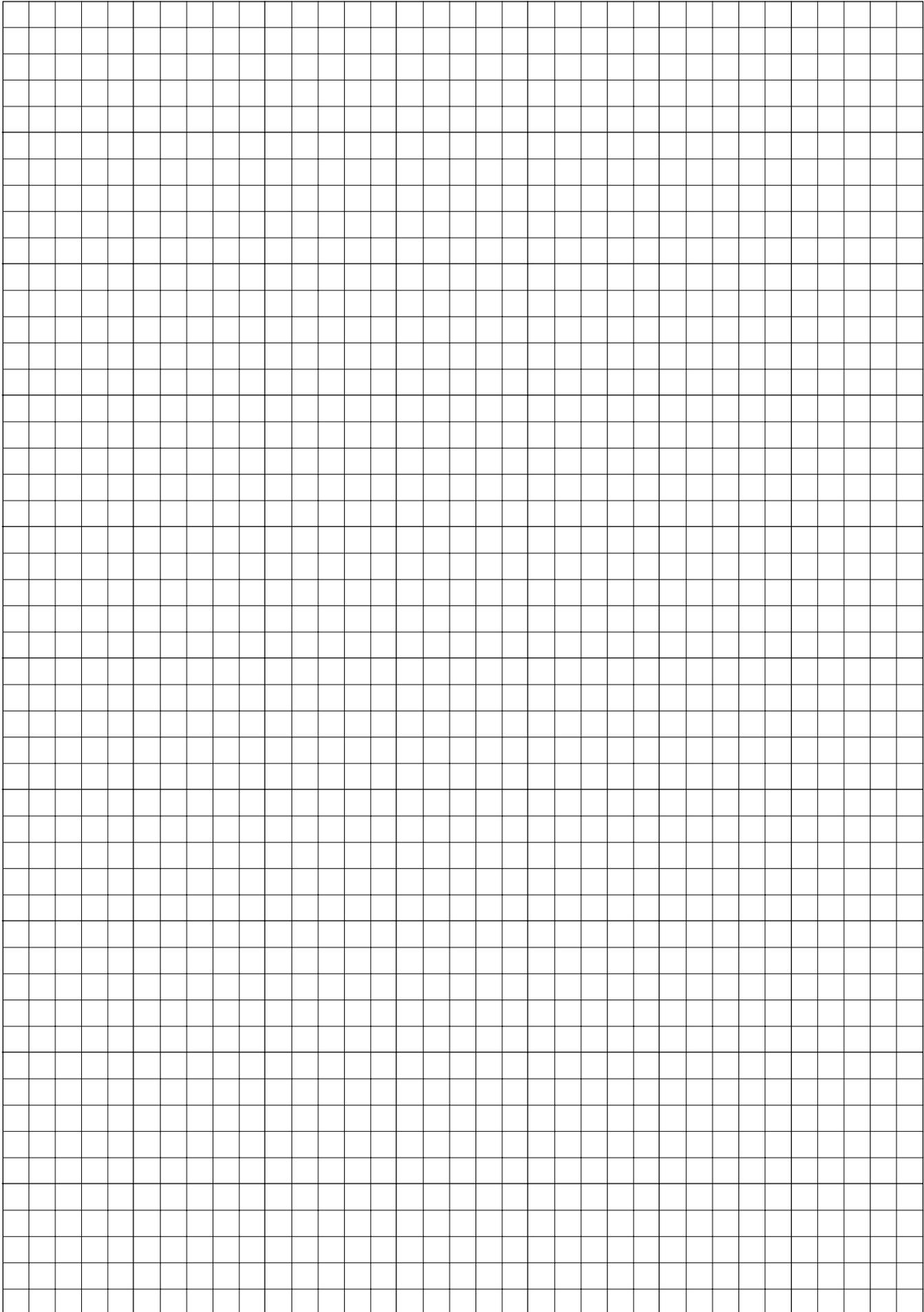
Scrap Graph Paper — This sheet will *not* be scored.

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MATHEMATICS B

Wednesday, August 13, 2003 — 8:30 to 11:30 a.m., only

ANSWER SHEET

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

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

Tear Here

