

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

MATHEMATICS B

Tuesday, August 17, 2004 — 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 23.

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 you to 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. [40]

1 Which condition does *not* prove that two triangles are congruent?

- (1) $SSS \cong SSS$ (3) $SAS \cong SAS$
(2) $SSA \cong SSA$ (4) $ASA \cong ASA$

Use this space for
computations.

2 The speed of a laundry truck varies inversely with the time it takes to reach its destination. If the truck takes 3 hours to reach its destination traveling at a constant speed of 50 miles per hour, how long will it take to reach the same location when it travels at a constant speed of 60 miles per hour?

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

3 Which set of ordered pairs is *not* a function?

- (1) $\{(3,1), (2,1), (1,2), (3,2)\}$
(2) $\{(4,1), (5,1), (6,1), (7,1)\}$
(3) $\{(1,2), (3,4), (4,5), (5,6)\}$
(4) $\{(0,0), (1,1), (2,2), (3,3)\}$

4 A circle has the equation $(x + 1)^2 + (y - 3)^2 = 16$. What are the coordinates of its center and the length of its radius?

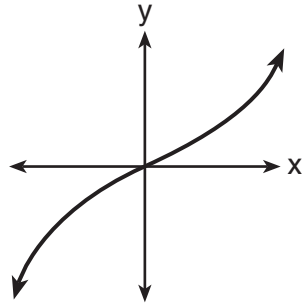
- (1) $(-1,3)$ and 4 (3) $(-1,3)$ and 16
(2) $(1,-3)$ and 4 (4) $(1,-3)$ and 16

5 The mean of a normally distributed set of data is 56, and the standard deviation is 5. In which interval do approximately 95.4% of all cases lie?

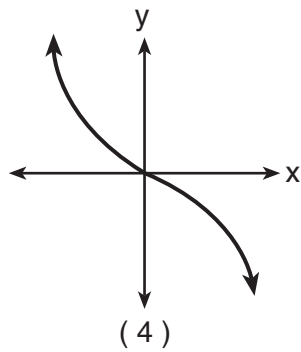
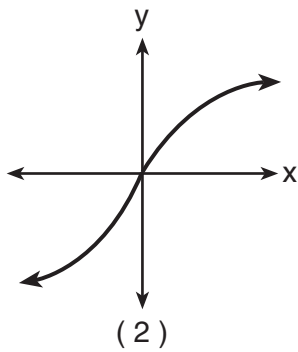
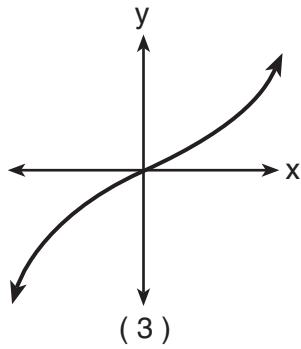
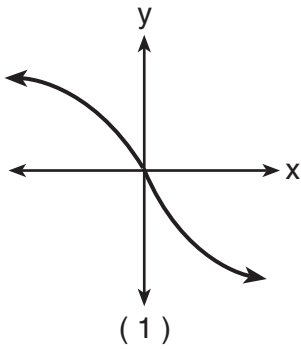
- (1) 46–56 (3) 51–61
(2) 46–66 (4) 56–71

6 The graph below represents $f(x)$.

Use this space for
computations.



Which graph best represents $f(-x)$?

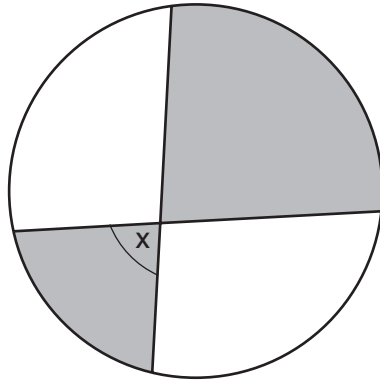


7 When simplified, $i^{27} + i^{34}$ is equal to

- | | |
|--------------|--------------|
| (1) i | (3) $-i - 1$ |
| (2) i^{61} | (4) $i - 1$ |

Use this space for computations.

- 8** The accompanying diagram shows a child's spin toy that is constructed from two chords intersecting in a circle. The curved edge of the larger shaded section is one-quarter of the circumference of the circle, and the curved edge of the smaller shaded section is one-fifth of the circumference of the circle.



What is the measure of angle x ?

- (1) 40° (3) 81°
(2) 72° (4) 108°
- 9** If $\sin A = \frac{4}{5}$, $\tan B = \frac{5}{12}$, and angles A and B are in Quadrant I, what is the value of $\sin(A + B)$?
- (1) $\frac{63}{65}$ (3) $\frac{33}{65}$
(2) $-\frac{63}{65}$ (4) $-\frac{33}{65}$
- 10** If the tangent of an angle is negative and its secant is positive, in which quadrant does the angle terminate?
- (1) I (3) III
(2) II (4) IV
- 11** The equation $2x^2 + 8x + n = 0$ has imaginary roots when n is equal to
- (1) 10 (3) 6
(2) 8 (4) 4

Use this space for
computations.

12 What is the middle term in the expansion of $(x + y)^4$?

(1) x^2y^2

(3) $6x^2y^2$

(2) $2x^2y^2$

(4) $4x^2y^2$

13 What is the image of point $(1,1)$ under $r_{x\text{-axis}} \circ R_{0,90^\circ}$?

(1) $(1,1)$

(3) $(-1,1)$

(2) $(1,-1)$

(4) $(-1,-1)$

14 How many distinct triangles can be formed if $m\angle A = 30$, side $b = 12$, and side $a = 8$?

(1) 1

(3) 3

(2) 2

(4) 0

15 The expression $\frac{(b^{2n+1})^3}{b^n \cdot b^{4n+3}}$ is equivalent to

(1) $\frac{b^n}{2}$

(3) b^{-3n}

(2) b^n

(4) b^{-3n+1}

16 What is the inverse of the function $y = \log_4 x$?

(1) $x^4 = y$

(3) $4^x = y$

(2) $y^4 = x$

(4) $4^y = x$

17 Which angle is coterminal with an angle of 125° ?

(1) -125°

(3) 235°

(2) -235°

(4) 425°

**Use this space for
computations.**

- 18** A ball is dropped from a height of 8 feet and allowed to bounce. Each time the ball bounces, it bounces back to half its previous height. The vertical distance the ball travels, d , is given by the formula $d = 8 + 16 \sum_{k=1}^n \left(\frac{1}{2}\right)^k$, where n is the number of bounces. Based on this formula, what is the total vertical distance that the ball has traveled after four bounces?

- (1) 8.9 ft (3) 22.0 ft
(2) 15.0 ft (4) 23.0 ft

- 19** The path traveled by a roller coaster is modeled by the equation $y = 27 \sin 13x + 30$. What is the maximum altitude of the roller coaster?

- (1) 13 (3) 30
(2) 27 (4) 57

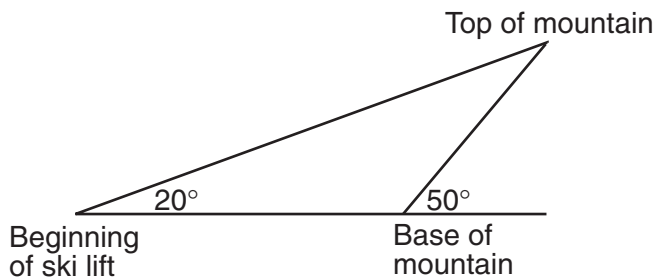
- 20** The expression $\frac{11}{\sqrt{3}-5}$ is equivalent to

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

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]

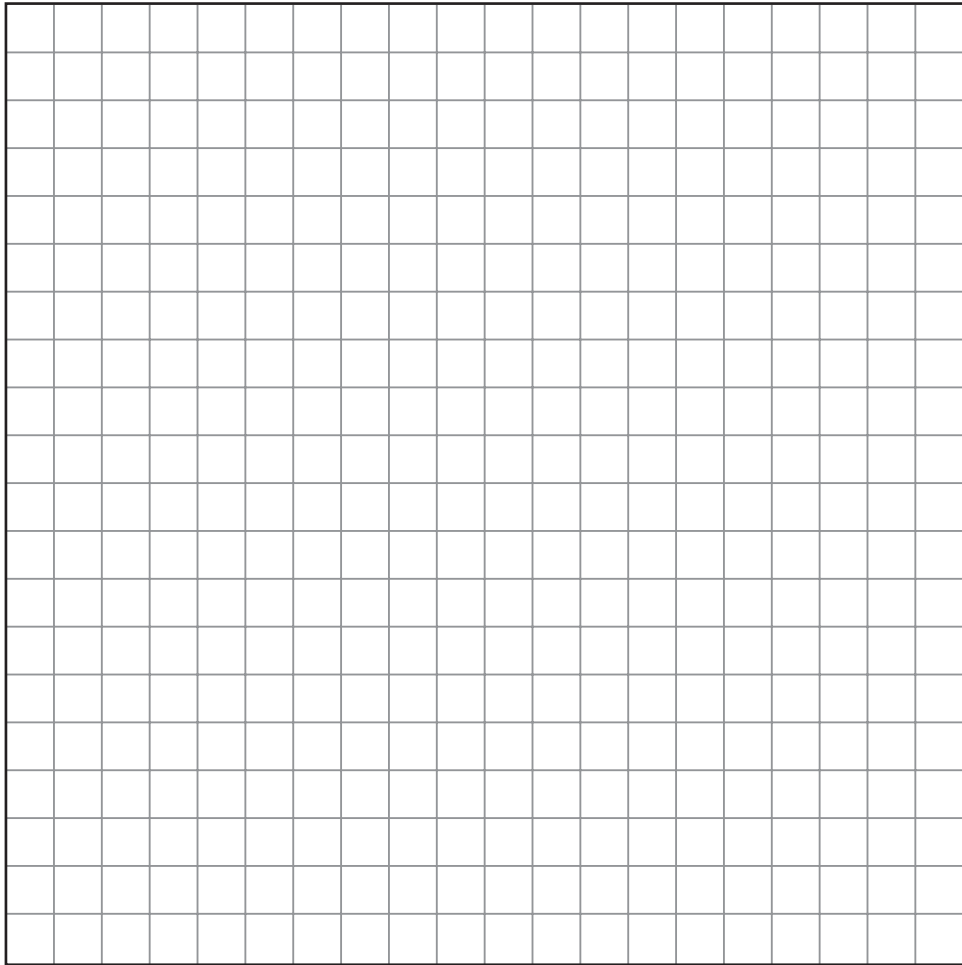
- 21 A ski lift begins at ground level 0.75 mile from the base of a mountain whose face has a 50° angle of elevation, as shown in the accompanying diagram. The ski lift ascends in a straight line at an angle of 20° . Find the length of the ski lift from the beginning of the ski lift to the top of the mountain, to the nearest hundredth of a mile.



22 Express $\sqrt{-48} + 3.5 + \sqrt{25} + \sqrt{-27}$ in simplest $a + bi$ form.

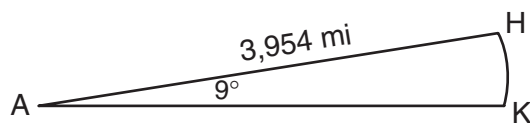
23 Solve for x : $x^{-3} = \frac{27}{64}$

24 The profit a coat manufacturer makes each day is modeled by the equation $P(x) = -x^2 + 120x - 2,000$, where P is the profit and x is the price for each coat sold. For what values of x does the company make a profit? [The use of the accompanying grid is optional.]



25 Express in simplest form: $\frac{\frac{1}{r} - \frac{1}{s}}{\frac{r^2}{s^2} - 1}$

26 Cities H and K are located on the same line of longitude and the difference in the latitude of these cities is 9° , as shown in the accompanying diagram. If Earth's radius is 3,954 miles, how many miles north of city K is city H along arc HK ? Round your answer to the *nearest tenth of a mile*.



(Not drawn to scale)

Part III

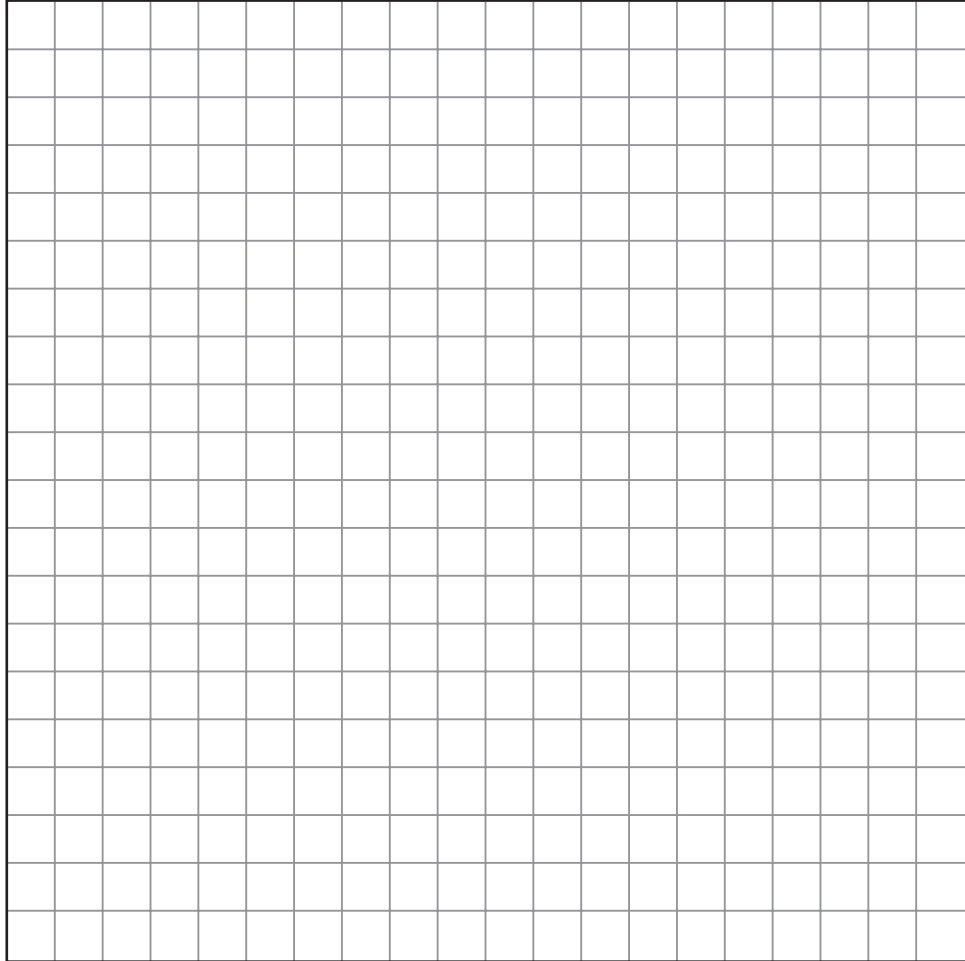
Answer all questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. [24]

- 27 A depth finder shows that the water in a certain place is 620 feet deep. The difference between d , the actual depth of the water, and the reading is $|d - 620|$ and must be less than or equal to $0.05d$. Find the minimum and maximum values of d , to the *nearest tenth of a foot*.

28 An amount of P dollars is deposited in an account paying an annual interest rate r (as a decimal) compounded n times per year. After t years, the amount of money in the account, in dollars, is given by the equation $A = P\left(1 + \frac{r}{n}\right)^{nt}$.

Rachel deposited \$1,000 at 2.8% annual interest, compounded monthly. In how many years, to the *nearest tenth of a year*, will she have \$2,500 in the account? [The use of the grid on the next page is optional.]

Question 28 continued



29 A box containing 1,000 coins is shaken, and the coins are emptied onto a table. Only the coins that land heads up are returned to the box, and then the process is repeated. The accompanying table shows the number of trials and the number of coins returned to the box after each trial.

Trial	0	1	3	4	6
Coins Returned	1,000	610	220	132	45

Write an exponential regression equation, rounding the calculated values to the *nearest ten-thousandth*.

Use the equation to predict how many coins would be returned to the box after the eighth trial.

30 Tim Parker, a star baseball player, hits one home run for every ten times he is at bat. If Parker goes to bat five times during tonight's game, what is the probability that he will hit *at least* four home runs?

31 A rectangular piece of cardboard is to be formed into an uncovered box. The piece of cardboard is 2 centimeters longer than it is wide. A square that measures 3 centimeters on a side is cut from each corner. When the sides are turned up to form the box, its volume is 765 cubic centimeters. Find the dimensions, in centimeters, of the original piece of cardboard.

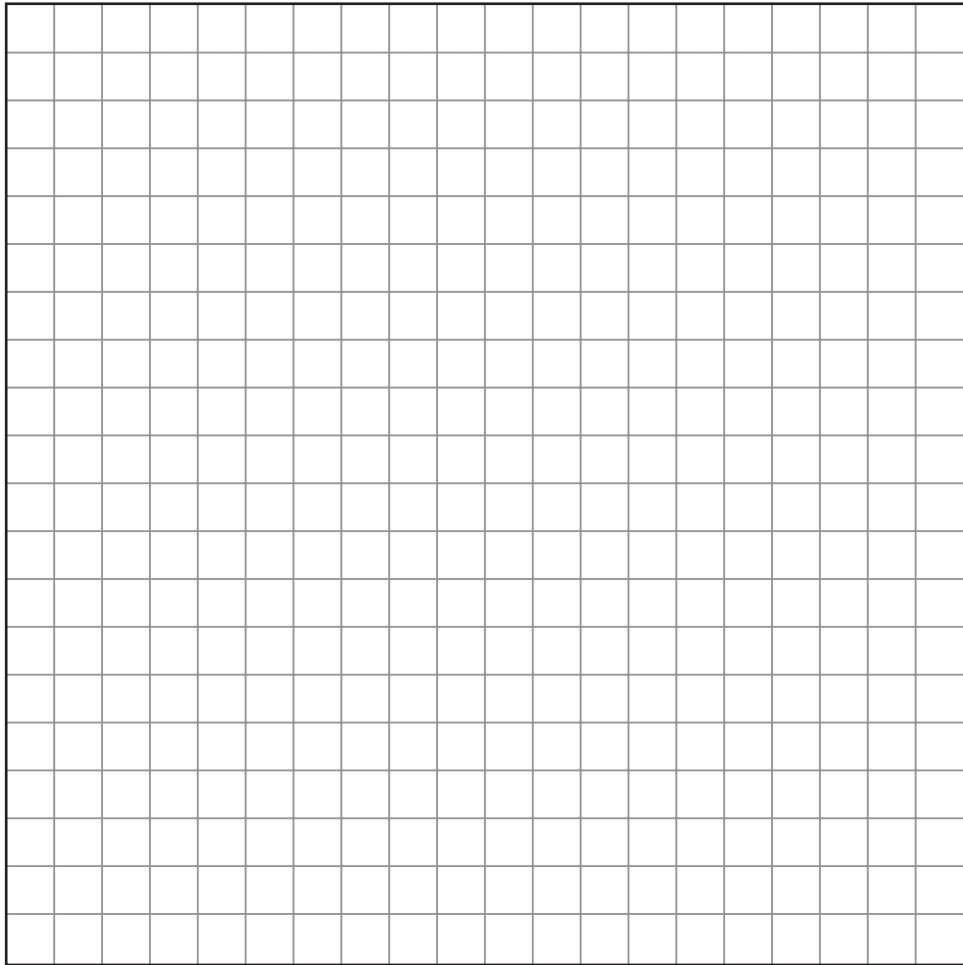
32 Solve algebraically for all values of θ in the interval $0^\circ \leq \theta < 360^\circ$ that satisfy the equation $\frac{\sin^2 \theta}{1 + \cos \theta} = 1$.

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]

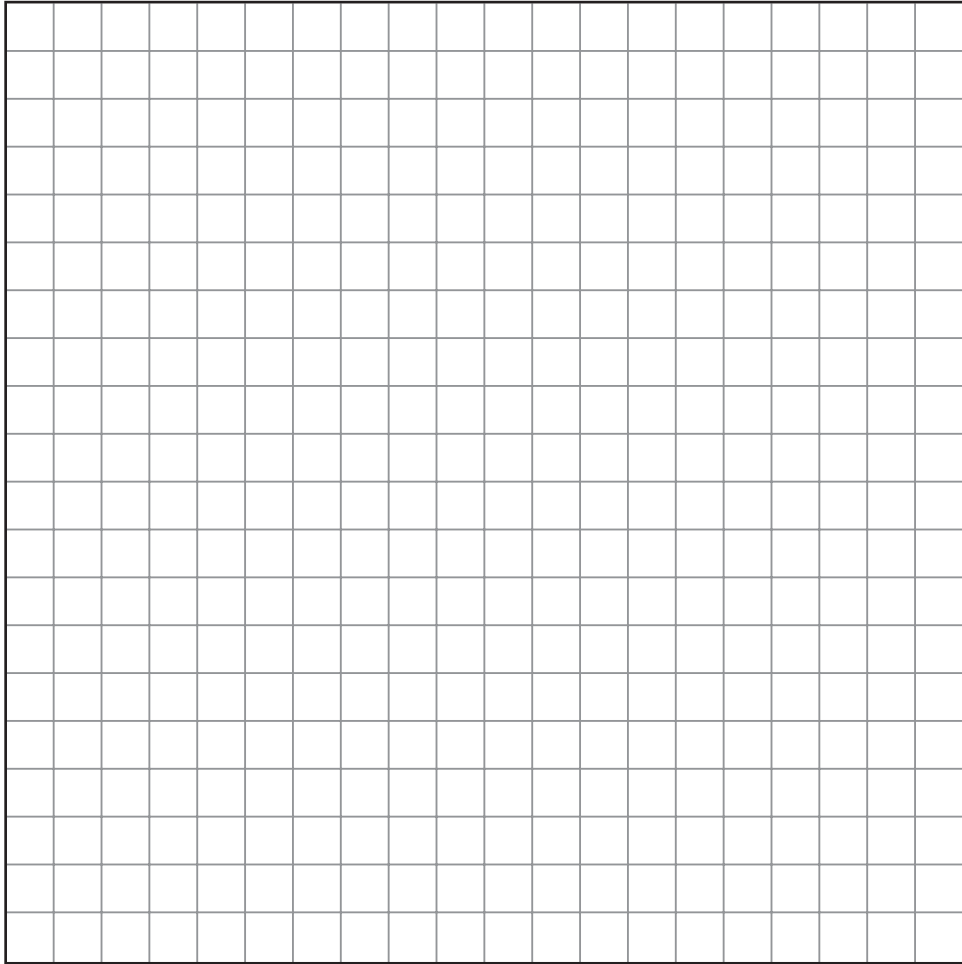
- 33** The tide at a boat dock can be modeled by the equation $y = -2 \cos\left(\frac{\pi}{6}t\right) + 8$, where t is the number of hours past noon and y is the height of the tide, in feet. For how many hours between $t = 0$ and $t = 12$ is the tide at least 7 feet? [The use of the grid on the next page is optional.]

Question 33 continued



34 The coordinates of quadrilateral $JKLM$ are $J(1,-2)$, $K(13,4)$, $L(6,8)$, and $M(-2,4)$. Prove that quadrilateral $JKLM$ is a trapezoid but *not* an isosceles trapezoid. [The use of the grid on the next page is optional.]

Question 34 continued



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

$$\sin(A + B) = \sin A \cos B + \cos A \sin B$$

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

Functions of the Double Angle

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A$$

$$\cos 2A = 2 \cos^2 A - 1$$

$$\cos 2A = 1 - 2 \sin^2 A$$

Functions of the Difference of Two Angles

$$\sin(A - B) = \sin A \cos B - \cos A \sin B$$

$$\cos(A - B) = \cos A \cos B + \sin A \sin B$$

Functions of the Half Angle

$$\sin \frac{1}{2} A = \pm \sqrt{\frac{1 - \cos A}{2}}$$

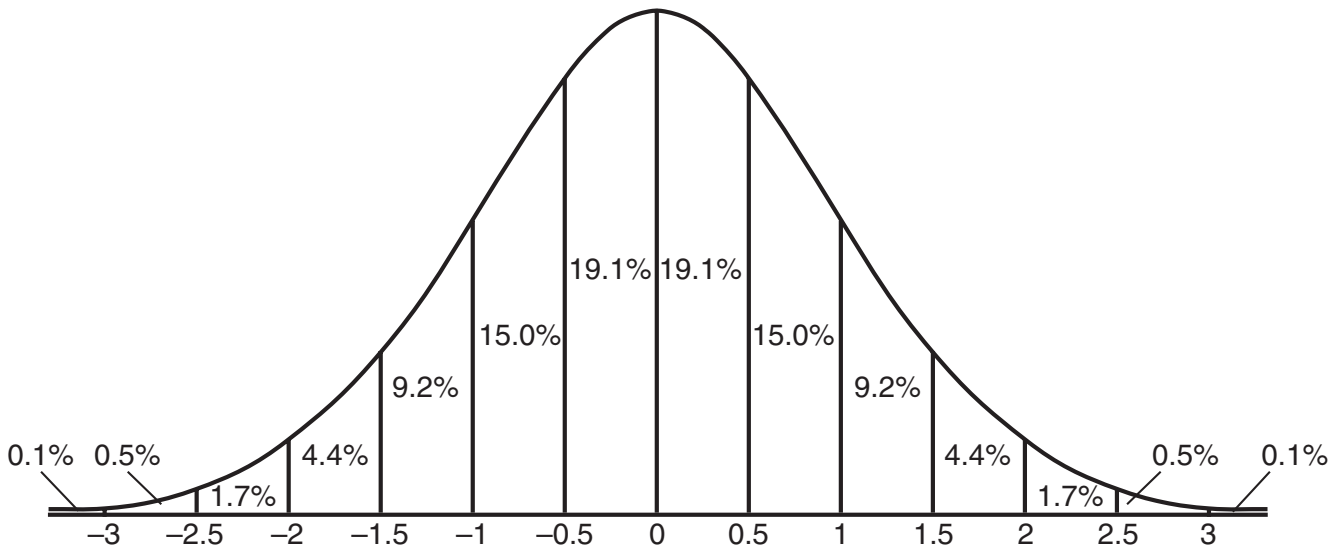
$$\cos \frac{1}{2} A = \pm \sqrt{\frac{1 + \cos A}{2}}$$

Law of Sines

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

Normal Curve

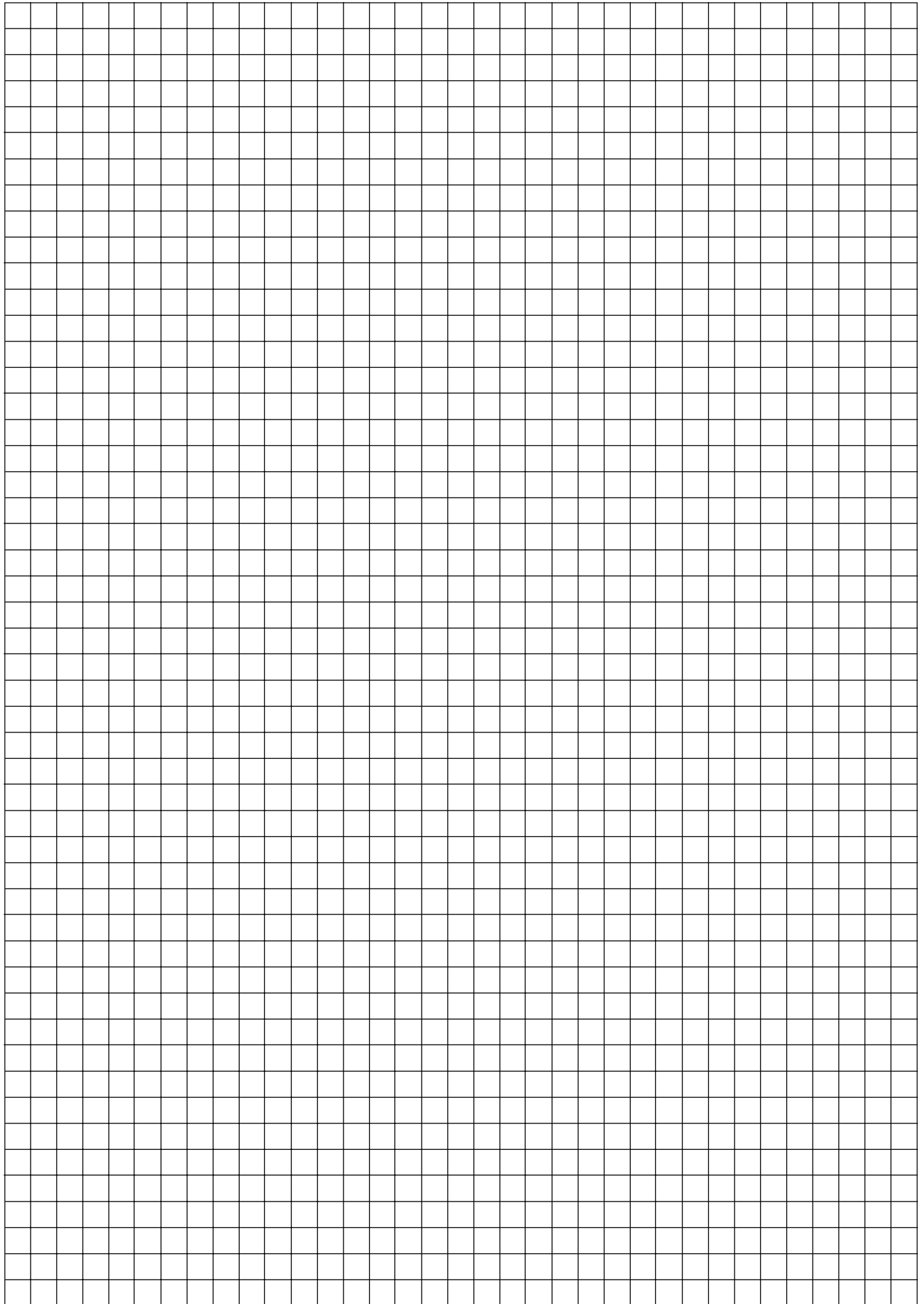
Standard Deviation



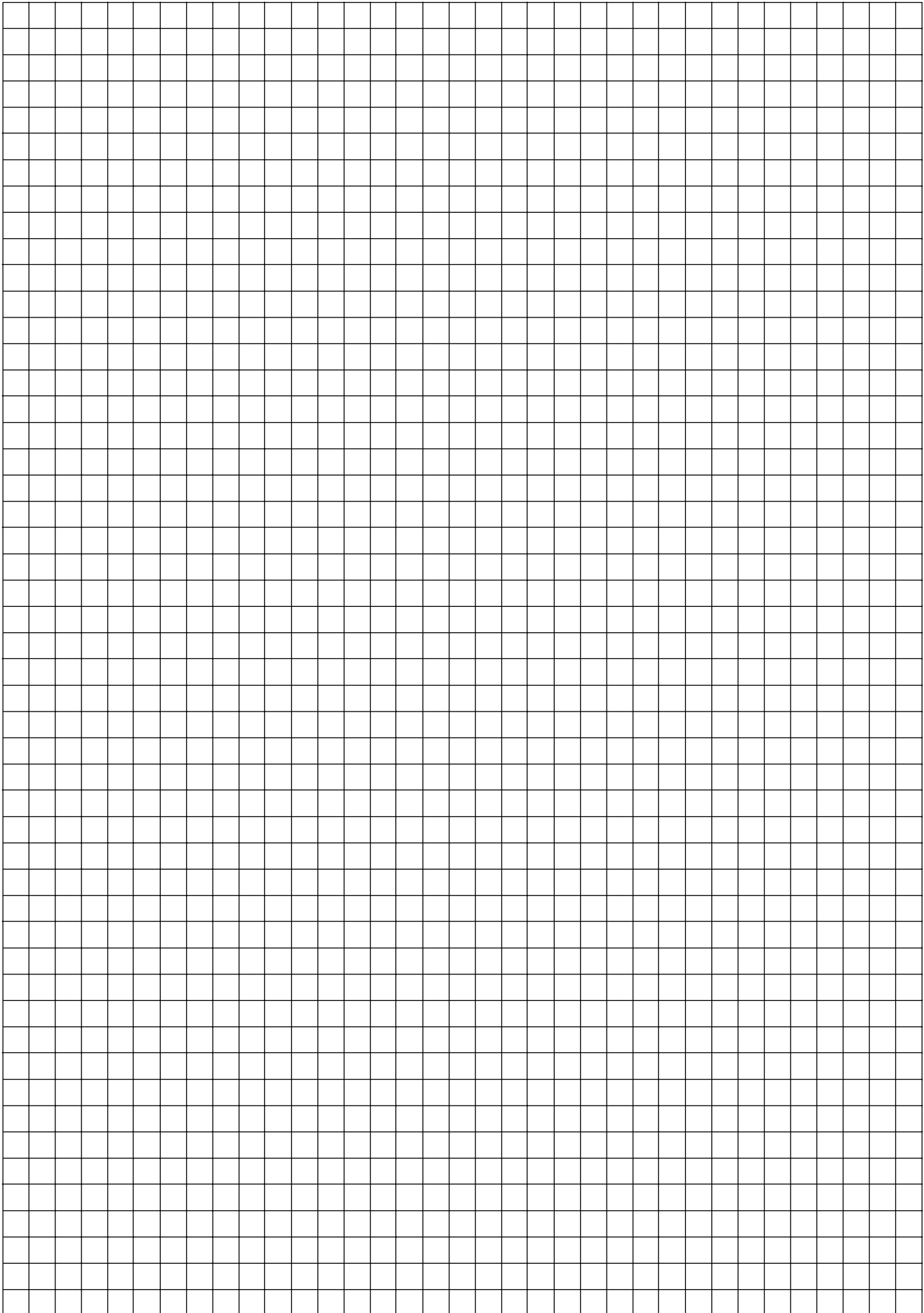
Scrap Graph Paper — This sheet will *not* be scored.

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MATHEMATICS B

Tuesday, August 17, 2004 — 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

