The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

MATHEMATICS B

Tuesday, June 15, 2010 — 9:15 a.m. to 12:15 p.m., only

Print Your Name: Mr. Sibol

Print Your School's Name: HS For Civil Rights

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. You may remove this sheet from this booklet. 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.

The formulas that you may need to answer some questions in this examination are found on page 19. This sheet is perforated so you may remove it from this booklet.

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.

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.

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

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]

Use this space for computations.

1 Pete and Sean decide to raise money for a charity by having a carnival in their backyard. In one of the games that they set up, the probability that a person will win is 0.4. If Robyn plays that game nine times, what is the probability that she wins *exactly* four times?

(1) ${}_9C_5\,(0.4)^5\,(0.4)^4$
(2) ${}_9C_4\,(0.5)^4\,(0.5)^5$
(3) ${}_9C_4\,(0.4)^4\,(0.6)^5$
(4) ${}_9C_5\,(0.4)^5\,(0.6)^4$

2 Which number is the largest?

(1) $\left(\frac{1}{4}\right)^{-1} = 4$
(2) $\left(\frac{1}{4}\right)^{0} = 1$
(3) $\left(\frac{1}{4}\right)^{\frac{1}{2}} = \frac{1}{2}$
(4) $\left(\frac{1}{4}\right)^{2} = \frac{1}{16}$

3 The point $A(6,3)$ maps onto $A'(2,1)$ under a dilation with respect to the origin. What is the constant of dilation?

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

4 If $\cos\theta = -\frac{4}{5}$ and θ lies in Quadrant II, what is the value of $\tan\theta$?

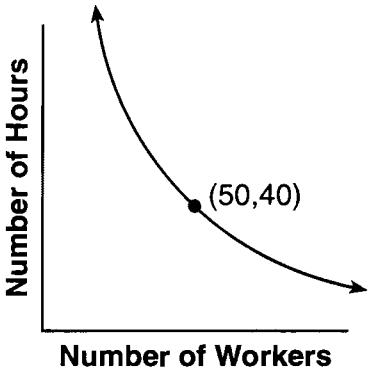
(1) $\frac{3}{4}$
(2) $\frac{4}{3}$
(3) $-\frac{3}{4}$
(4) $-\frac{4}{3}$

then $\sin\theta = \frac{3}{5}$

$\tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{\frac{3}{5}}{\frac{-4}{5}} = -\frac{3}{4}$

Use this space for computations.

5 Tracy, a political campaign organizer, realizes that the number of hours needed to get out a mailing for her candidate is inversely proportional to the number of campaign workers she has. If she uses the information in the accompanying graph, how many hours would it take to do the mailing if 125 workers are used?



$w_1 h_1 = w_2 h_2$

$50 \cdot 40 = 125 h_2$

$\frac{2000}{125} = \frac{125 h_2}{125}$

$16 = h_2$

(1) 12
(2) 16
(3) 20
(4) 24

6 What is $\frac{\tan x}{\sec x}$ expressed in simplest form?

(1) $\frac{\sin x}{\cos^2 x}$
(2) $\frac{1}{\cos x}$
(3) $\frac{\sin^2 x}{\cos x}$
(4) $\sin x$

$\frac{\frac{\sin x}{\cos x}}{\frac{1}{\cos x}} = \frac{\sin x}{\cos x} \times \frac{\cos x}{1}$

7 What is the value of $\sum_{r=0}^{3} {}_3C_r$?

(1) 8
(2) 9
(3) 3
(4) 4

r	${}_3C_r$
0	1
1	3
2	3
3	1
	8

Use this space for computations.

8 What is the exact value of $\cos(\text{Arc } \sin \frac{1}{2})$?

(1) $\frac{1}{2}$

(2) $\sqrt{3}$

(3) $\frac{\sqrt{3}}{2}$

(4) $\frac{\sqrt{2}}{2}$

9 If $7^x = 3$, then x is equal to

(1) $(\log 3)(\log 7)$

(2) $\log 3 - \log 7$

(3) $\frac{\log 3}{\log 7}$

(4) $\frac{\log 7}{\log 3}$

$\log 7^x = \log 3$

$x \log 7 = \log 3$

$x = \frac{\log 3}{\log 7}$

10 The roots of the equation $2x^2 + 5x - 6 = 0$ are

(1) rational and unequal

(2) rational and equal

(3) irrational and unequal

(4) imaginary

$b^2 - 4ac$

$5^2 - 4(2)(-6)$

$25 + 48$

11 If the measure of $\angle A = 40°$, $a = 5$, and $b = 6$, how many different triangles can be constructed?

(1) 1

(2) 2

(3) 3

(4) 0

$\frac{5}{\sin 40} = \frac{6}{\sin B}$

$B = 50.5$ $\quad 50.5 + 40 < 180$

$B = 129.5$ $\quad 129.5 + 40 < 180$

12 Which is the equation of the axis of symmetry of the graph of the equation $y = x^2 - 3x - 6$?

(1) $x = 3$

(2) $x = \frac{3}{2}$

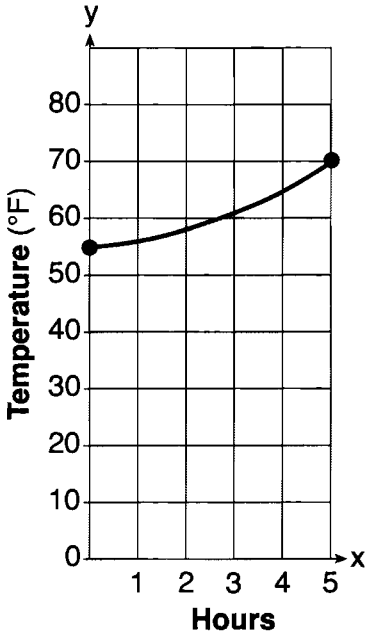
(3) $y = 3$

(4) $y = \frac{3}{2}$

$x = \frac{-b}{2a} = \frac{(-3)}{2(1)} = +\frac{3}{2}$

Use this space for computations.

13 The air temperature in Dallas, Texas, over a 5-hour period is shown in the accompanying graph.



What is the range of this set of data?

(1) $0 \le x \le 5$
(2) $56 \le x \le 70$
(3) $0 \le y \le 80$
(4) $56 \le y \le 70$

14 The expression $\frac{1}{2-i}$ is equivalent to

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

$\frac{1}{2-i} \cdot \frac{2+i}{2+i} = \frac{2+i}{4-i^2} = \frac{2+i}{5}$

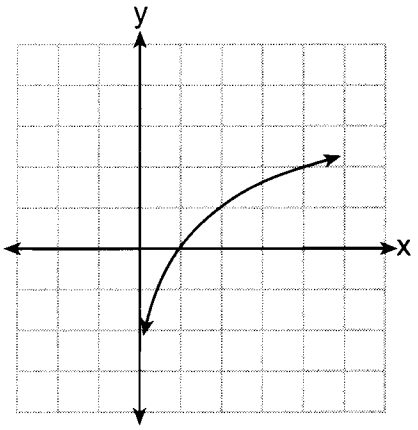
15 If $f(x) = 2x - 1$ and $g(x) = 3x + 5$, then $(f \circ g)(x)$ is equal to

(1) $5x + 4$
(2) $6x + 2$
(3) $6x + 9$
(4) $6x^2 + 7x - 5$

$2(3x+5) - 1$
$6x + 10 - 1$
$6x + 9$

Use this space for computations.

16 Which equation is represented by the accompanying graph?



(1) $y = 2^x$
(2) $y = 2^{-x}$
(3) $y = \log x$
(4) $y = \log_2 x$

17 Which quadratic equation has the roots $2 - \sqrt{3}$ and $2 + \sqrt{3}$?

(1) $x^2 - 4x + 7 = 0$
(2) $x^2 + 4x + 7 = 0$
(3) $x^2 - 4x + 1 = 0$
(4) $x^2 + 4x - 1 = 0$

sum of roots = 4
product of roots = 4 − 3 = 1

$\text{sum} = \frac{-b}{a} = \frac{-(-4)}{1} = 4$

$\text{products } \frac{c}{a} = \frac{1}{1} = 1$

18 What is the solution set of $\sqrt{4x + 21} = x$?

(1) {−3}
(2) {−3, 7}
(3) {7}
(4) { }

$4x + 21 = x^2$

$0 = x^2 - 4x - 21$

$0 = (x - 7)(x + 3)$

$x = 7$ $\quad x = -3$ extraneous

19 The graph of the product of $(4 + 3i)$ and $(2 - 3i)$ lies in which quadrant?

(1) I
(2) II
(3) III
(4) IV

$8 - 12i + 6i - 9i^2$

$17 - 6i$

20 Which equation represents an ellipse?

(1) $3x^2 = 4 - 5y^2$
(2) $4x^2 = 9 - 4y$ parabola
(3) $6x^2 = 9 + 8y^2$ hyperbolas
(4) $xy = 12$

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 Simplify: $\dfrac{\frac{1}{4}+\frac{1}{4x}}{\frac{1}{x}+\frac{1}{4}}$

$$\frac{\frac{4x+4}{16x}}{\frac{4+x}{4x}} = \frac{4(x+1)}{16x} \times \frac{4x}{x+4} = \frac{x+1}{x+4}$$

22 In $\triangle ABC$, $a = 12$, $b = 20.5$, and $m\angle C = 73$. Find the area of $\triangle ABC$, to the *nearest tenth*.

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

$= \frac{1}{2}(12)(20.5)\sin 73 \approx 117.6$

23 Solve for x: $\left(x^{\frac{1}{3}}\right)^3 = 27^3$

$x = 19,683$

24 Solve for x: $x^2 - 7x + 10 < 0$

$(x-5)(x-2) < 0$

$x-5 < 0$ and $x-2 > 0$ or ~~$x-5 > 0$ and $x-2 < 0$~~

$x < 5$ and $x > 2$ ~~$x > 5$ and $x < 2$~~

$2 < x < 5$

25 During a recent time period, the following Apgar scores were recorded at St. Elizabeth's Hospital: 9, 8, 10, 9, 8, 10, 9, 10, 8, 10. Find the population standard deviation of the scores, to the *nearest hundredth*.

.83

26 The tip of a pendulum describes an arc 18 centimeters long when the pendulum swings through an angle of $\frac{3}{4}$ of a radian. Find the length, in centimeters, of the pendulum.

$$\theta = \frac{s}{r}$$

$$\frac{3}{4} = \frac{18}{r}$$

$$\frac{3r}{3} = \frac{72}{3}$$

$$r = 24$$

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 The data table below shows water temperatures at various depths in an ocean.

Water Depth (x) (meters)	**Temperature (y)** (°C)
50	18
75	15
100	12
150	7
200	1

Write the linear regression equation for this set of data, rounding all values to the *nearest thousandth*. $y = -.112x + 23.448$

Using this equation, predict the temperature (°C), to the *nearest integer*, at a water depth of 255 meters.

$-5 \approx -.122(255) + 23.448$

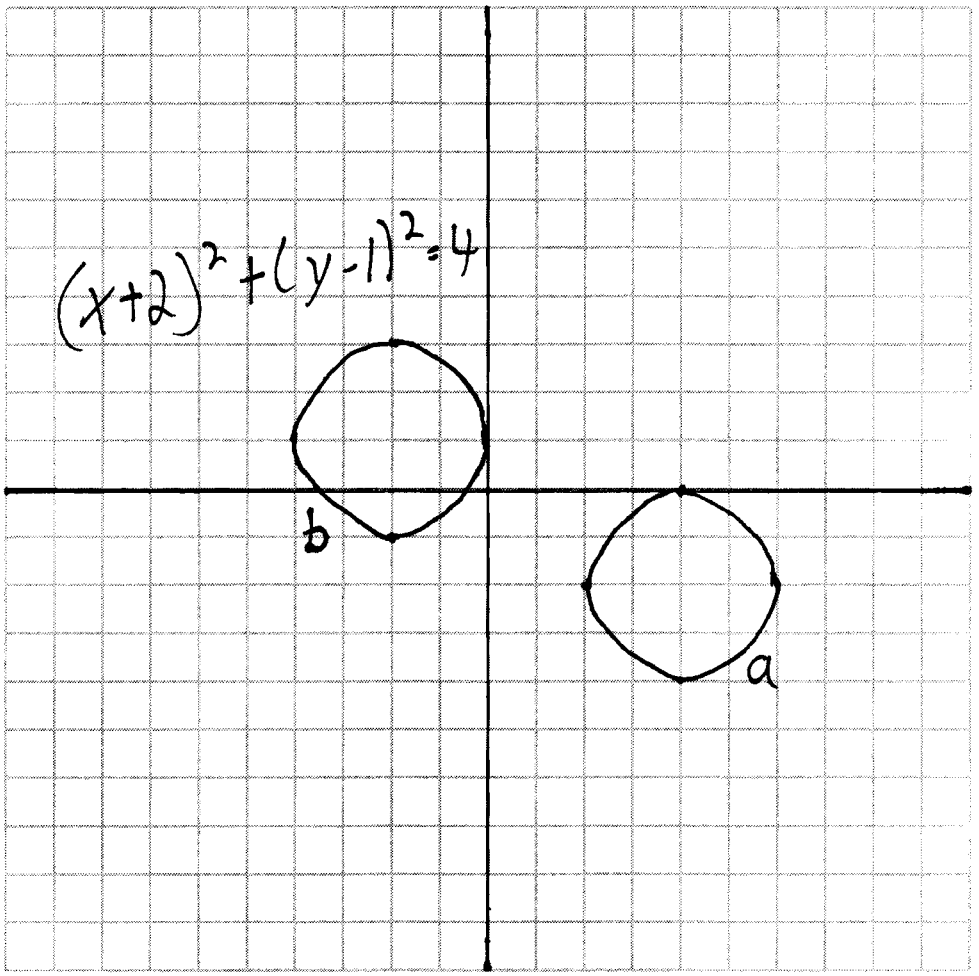
28 Express $\frac{35x^2 + 2x - 1}{15x + 3} \div \frac{2 - 98x^2}{6 + 42x}$ in simplest form.

$$\frac{(7x-1)(5x+1)}{3(5x+1)} \times \frac{6(1+7x)}{2(1-49x^2)}$$

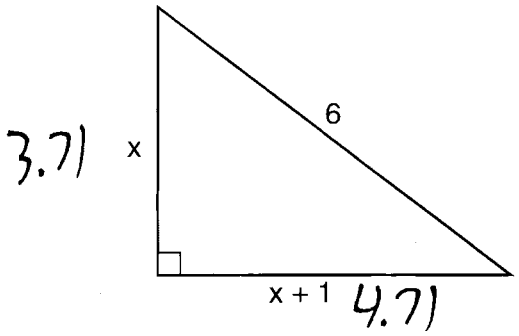
$$\frac{(7x-1)(1+7x)}{(1-7x)(1+7x)}$$

$$-1$$

29 A shape to be used in a computer game is placed on a Cartesian coordinate plane. The equation of the shape is $(x - 4)^2 + (y + 2)^2 = 4$. On the accompanying grid, graph the shape and label it a. In the game, the shape is moved under the composition $T_{2,3} \circ r_{y\text{-axis}}$. Draw the image, label it b, and state its equation.



30 As shown in the accompanying diagram, the hypotenuse of the right triangle is 6 meters long. One leg is 1 meter longer than the other. Find the lengths of *both* legs of the triangle, to the *nearest hundredth of a meter.*



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

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

$x^2 + x^2 + 2x + 1 = 36$

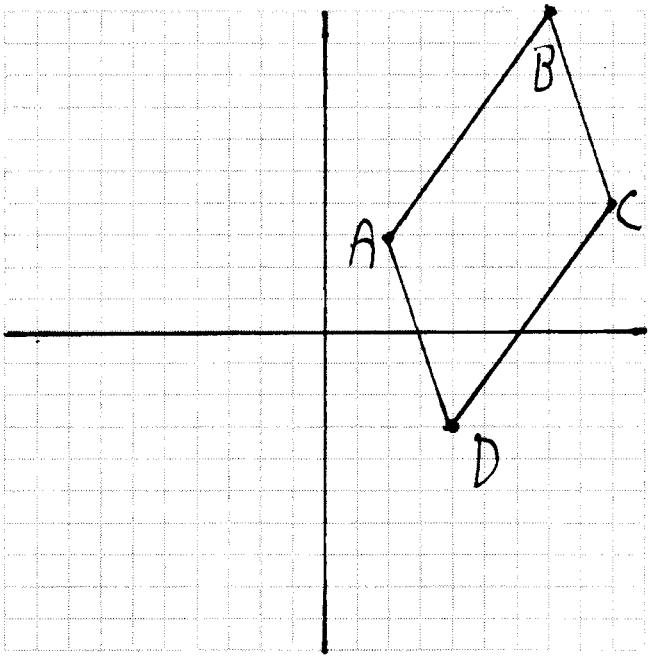
$2x^2 + 2x - 35 = 0$

$$x = \frac{-2 \pm \sqrt{2^2 - 4(2)(-35)}}{2(2)}$$

$$\frac{-2 \pm \sqrt{284}}{4} \approx 3.71$$

31 Quadrilateral $ABCD$ has vertices $A(2,3)$, $B(7,10)$, $C(9,4)$, and $D(4,-3)$. Prove that $ABCD$ is a parallelogram but *not* a rhombus. [The use of the accompanying grid is optional.]

STATEMENT	REASON
① Quadrilateral ABCD with vertices A(2,3), B(7,10), C(9,4), & D(4,-3)	① Given
② $m_{\overline{AB}} = \frac{10-3}{7-2} = \frac{7}{5}$ $m_{\overline{CD}} = \frac{4--3}{9-4} = \frac{7}{5}$ $m_{\overline{AD}} = \frac{3--3}{2-4} = \frac{6}{-2} = -3$ $m_{\overline{BC}} = \frac{10-4}{7-9} = -3$	② Definition of slope
③ $\overline{AB} \parallel \overline{CD}$ $\overline{AD} \parallel \overline{BC}$	③ Parallel lines have equal slope
④ Quadrilateral ABCD is a parallelogram	④ Definition of parallelogram
⑤ $d_{\overline{AD}} = \sqrt{(2-4)^2+(3--3)^2} = \sqrt{40}$ $d_{\overline{AB}} = \sqrt{(7-2)^2+(10-3)^2} = \sqrt{74}$	⑤ Definition of distance
⑥ $\overline{AD} \not\cong \overline{AB}$	⑥ Congruent lines have equal
⑦ ABCD is not a rhombus	⑦ A rhombus has 4 equal distance sides



32 Solve the following system of equations algebraically.

$$x^2 - 2y^2 = 23$$
$$x - 2y = 7$$

$x = 2y + 7$

$(2y+7)^2 - 2y^2 = 23$

$4y^2 + 14y + 14y + 49 - 2y^2 = 23$

$2y^2 + 28y + 26 = 0$

$y^2 + 14y + 13 = 0$

$(y+13)(y+1) = 0$

$y = -13 \quad y = -1$

$x = 2y + 7$ $\quad$ $x = 2y + 7$

$= 2(-13) + 7$ $\quad$ $= 2(-1) + 7$

$= -19$ $\quad$ $= 5$

$(-19, -13)$ $\quad$ $(5, -1)$

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 In triangle RST, $RS = 50$, $ST = 58$, and $m\angle S = 46$.

Find RT, to the *nearest tenth*.

Using your value for RT, find $m\angle R$, to the *nearest degree*.

$$5^2 = 50^2 + 58^2 - 2(50)(58)\cos 46$$

$$5 \approx 42.8$$

$$\frac{42.8}{\sin 46} = \frac{58}{\sin R}$$

$$R \approx 77$$

34 Solve algebraically for all values of θ in the interval $0° \leq x < 360°$.

$$2 \sin^2 \theta - 4 \sin \theta = \cos^2 \theta - 2$$

Express your answers to the *nearest degree*.

$2\sin^2\theta - 4\sin\theta = 1 - \sin^2\theta - 2$

$3\sin^2\theta - 4\sin\theta + 1 = 0$

$(3\sin\theta - 1)(\sin\theta - 1) = 0$

$3\sin\theta - 1 = 0$

$\sin\theta = \frac{1}{3}$

$\theta = 19°, 161°$

$\sin\theta - 1 = 0$

$\sin\theta = 1$

$\theta = 90$