

# ALGEBRA 2/TRIGONOMETRY

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

# ALGEBRA 2/TRIGONOMETRY

Tuesday, June 19, 2012 — 1:15 to 4:15 p.m., only

Student Name: Mr. Sobel

School Name: J.P.S.

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. 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. 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.

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 27 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. [54]

*conjugates - use FL*

Use this space for computations.

1 What is the product of  $(\frac{2}{5}x - \frac{3}{4}y^2)$  and  $(\frac{2}{5}x + \frac{3}{4}y^2)$ ?

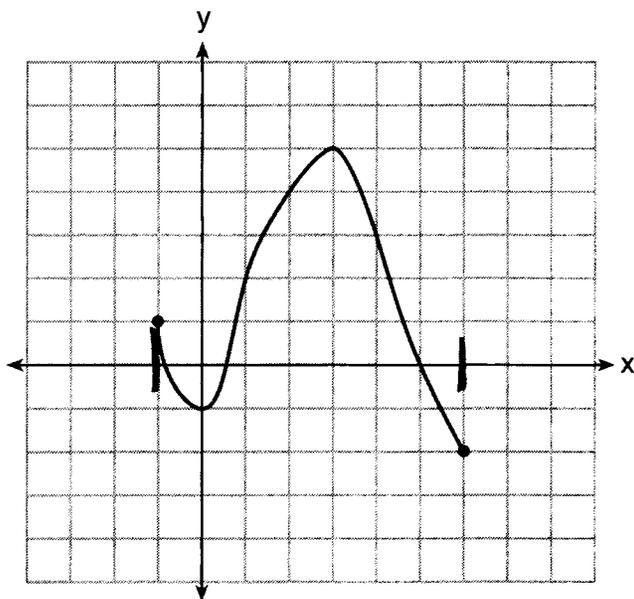
(1)  $\frac{4}{25}x^2 - \frac{9}{16}y^4$

(3)  $\frac{2}{5}x^2 - \frac{3}{4}y^4$   $\frac{4}{25}x^2 - \frac{9}{16}y^4$

(2)  $\frac{4}{25}x - \frac{9}{16}y^2$

(4)  $\frac{4}{5}x$

2 What is the domain of the function shown below?



(1)  $-1 \leq x \leq 6$

(3)  $-2 \leq x \leq 5$

(2)  $-1 \leq y \leq 6$

(4)  $-2 \leq y \leq 5$

Use this space for  
computations.

3 What is the solution set for  $2\cos\theta - 1 = 0$  in the interval  
 $0^\circ \leq \theta < 360^\circ$ ?

(1)  $\{30^\circ, 150^\circ\}$

(3)  $\{30^\circ, 330^\circ\}$

(2)  $\{60^\circ, 120^\circ\}$

(4)  $\{60^\circ, 300^\circ\}$

$$2\cos\theta = 1$$

$$\cos\theta = \frac{1}{2}$$

$$\theta = \cos^{-1}\frac{1}{2}$$

4 The expression  $\sqrt[3]{64a^{16}}$  is equivalent to

(1)  $8a^4$

(3)  $4a^5\sqrt[3]{a}$

(2)  $8a^8$

(4)  $4a^3\sqrt[3]{a^5}$

$$\sqrt[3]{64a^{15}a} = 4a^5\sqrt[3]{a}$$

5 Which summation represents  $5 + 7 + 9 + 11 + \dots + 43$ ?

(1)  $\sum_{n=5}^{43} n$

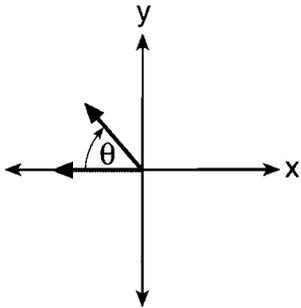
(3)  $\sum_{n=4}^{24} (2n - 3)$

(2)  $\sum_{n=1}^{20} (2n + 3)$

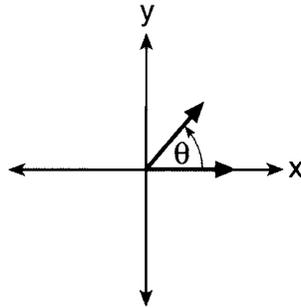
(4)  $\sum_{n=3}^{23} (3n - 4)$

Use this space for computations.

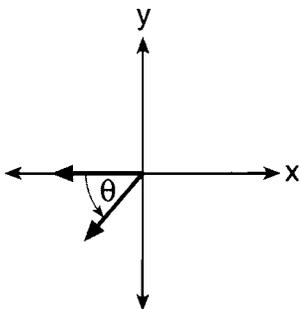
6 If  $m\angle\theta = -50$ , which diagram represents  $\theta$  drawn in standard position?



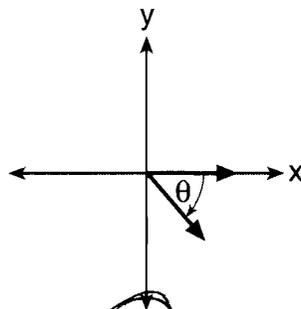
(1)



(3)



(2)



(4)

7 If  $\log_b x = 3 \log_b p - \left(2 \log_b t + \frac{1}{2} \log_b r\right)$ , then the value of  $x$  is

(1)  $\frac{p^3}{\sqrt{t^2 r}}$

(3)  $\frac{p^3 t^2}{\sqrt{r}}$

(2)  $p^3 t^2 r^{\frac{1}{2}}$

(4)  $\frac{p^3}{t^2 \sqrt{r}}$

8 Which equation has roots with the sum equal to  $\frac{9}{4}$  and the product equal to  $\frac{3}{4}$ ?   
 sum:  $\frac{-b}{a}$    
 product:  $\frac{c}{a}$

(1)  $4x^2 + 9x + 3 = 0$

(3)  $4x^2 - 9x + 3 = 0$

(2)  $4x^2 + 9x - 3 = 0$

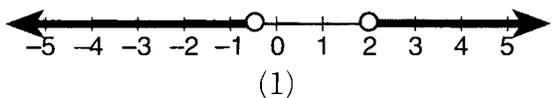
(4)  $4x^2 - 9x - 3 = 0$

$s: -\frac{9}{4} \quad p: -\frac{3}{4}$

$s: \frac{9}{4} \quad p: -\frac{3}{4}$

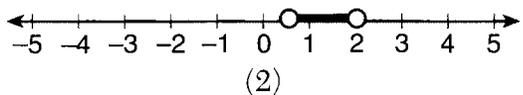
Use this space for  
computations.

9 Which graph represents the solution set of  $\left|\frac{4x-5}{3}\right| > 1$ ?



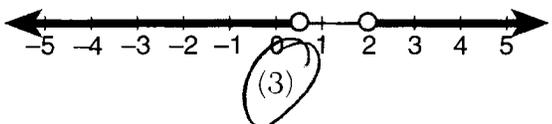
$$\frac{4x-5}{3} > 1$$

$$\frac{4x-5}{3} < -1$$



$$4x-5 > 3$$

$$4x-5 < -3$$

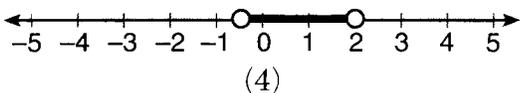


$$4x > 8$$

$$4x < 2$$

$$x > 2$$

$$x < \frac{1}{2}$$



10 Which expression is equivalent to  $\frac{x^{-1}y^4}{3x^{-5}y^{-1}}$ ?

$$\frac{x^4 y^5}{3}$$

(1)  $\frac{x^4 y^5}{3}$

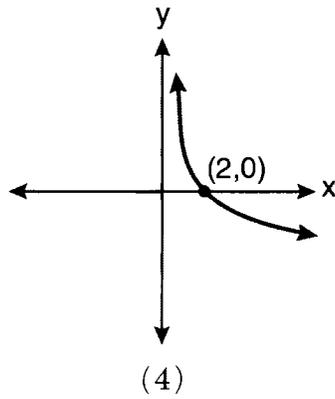
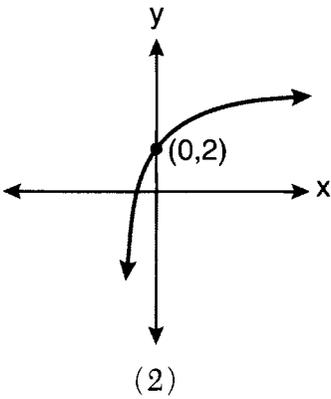
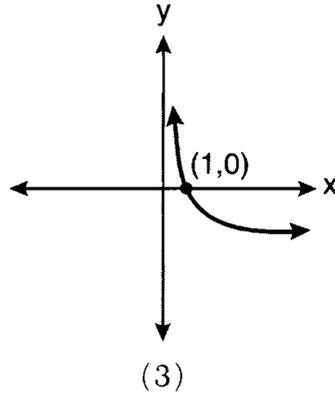
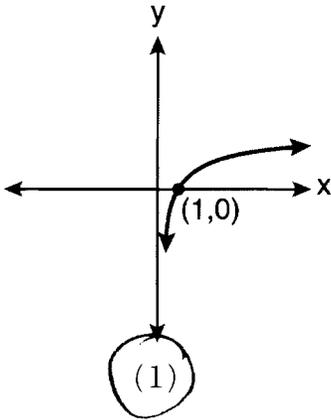
(3)  $3x^4 y^5$

(2)  $\frac{x^5 y^4}{3}$

(4)  $\frac{y^4}{3x^5}$

Use this space for computations.

11 Which graph represents the function  $\log_2 x = y$ ?



12 A circle is drawn to represent a pizza with a 12 inch diameter. The circle is cut into eight congruent pieces. What is the length of the outer edge of any one piece of this circle?

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

$$\begin{aligned} s &= \theta r \\ &= \frac{2\pi}{8} \cdot 6 \\ &= \frac{3\pi}{2} \end{aligned}$$



Use this space for computations.

16 Which expression is equivalent to  $(n \circ m \circ p)(x)$ , given  $m(x) = \sin x$ ,  $n(x) = 3x$ , and  $p(x) = x^2$ ?

- (1)  $\sin(3x)^2$                       (3)  $\sin^2(3x)$   
(2)  $3\sin x^2$                       (4)  $3\sin^2 x$

17 The value of  $\csc 138^\circ 23'$  rounded to four decimal places is

- (1)  $-1.3376$                       (3)  $1.5012$   
(2)  $-1.3408$                       (4)  $1.5057$

$$\frac{1}{\sin 138^\circ 23'}$$

18 Which function is one-to-one?

- (1)  $k(x) = x^2 + 2$  ✗                      (3)  $f(x) = |x| + 2$  ✗  
(2)  $g(x) = x^3 + 2$  ✗                      (4)  $j(x) = x^4 + 2$  ✗

19 The conjugate of the complex expression  $-5x + 4i$  is

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

20 What is a positive value of  $\tan \frac{1}{2}x$ , when  $\sin x = 0.8$ ?

- (1)  $0.5$                       (3)  $0.33$  ( $\cos x = .6$ )  
(2)  $0.4$                       (4)  $0.25$

$$\tan \frac{1}{2}x = \sqrt{\frac{1 - .6}{1 + .6}} = \sqrt{\frac{.4}{1.6}} = .5$$

Use this space for computations.

21 The table below displays the results of a survey regarding the number of pets each student in a class has. The average number of pets per student in this class is 2.

Number of Pets	0	1	2	3	4	5
Number of Students	4	6	10	0	$k$	2

What is the value of  $k$  for this table?

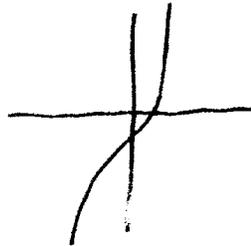
- (1) 9  
 (2) 2  
 (3) 8  
 (4) 4

$$\frac{4 \cdot 0 + 6 \cdot 1 + 10 \cdot 2 + 0 \cdot 3 + k \cdot 4 + 2 \cdot 5}{4 + 6 + 10 + 0 + k + 2} = 2$$

$$\frac{36 + 4k}{k + 22} = 2$$

22 How many negative solutions to the equation  $2x^3 - 4x^2 + 3x - 1 = 0$  exist?

- (1) 1  
 (2) 2  
 (3) 3  
 (4) 0



$$4k + 36 = 2k + 44$$

$$2k = 8$$

$$k = 4$$

23 A study finds that 80% of the local high school students text while doing homework. Ten students are selected at random from the local high school. Which expression would be part of the process used to determine the probability that, at most, 7 of the 10 students text while doing homework?

- (1)  ${}_{10}C_6 \left(\frac{4}{5}\right)^6 \left(\frac{1}{5}\right)^4$   
 (2)  ${}_{10}C_7 \left(\frac{4}{5}\right)^{10} \left(\frac{1}{5}\right)^7$   
 (3)  ${}_{10}C_8 \left(\frac{7}{10}\right)^{10} \left(\frac{3}{10}\right)^2$   
 (4)  ${}_{10}C_9 \left(\frac{7}{10}\right)^9 \left(\frac{3}{10}\right)^1$

Use this space for  
computations.

24 In which interval of  $f(x) = \cos(x)$  is the inverse also a function?

(1)  $-\frac{\pi}{2} < x < \frac{\pi}{2}$

(3)  $0 \leq x \leq \pi$

(2)  $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$

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

25 As shown in the table below, a person's target heart rate during exercise changes as the person gets older.

Age (years)	Target Heart Rate (beats per minute)
20	135
25	132
30	129
35	125
40	122
45	119
50	115

Which value represents the linear correlation coefficient, rounded to the *nearest thousandth*, between a person's age, in years, and that person's target heart rate, in beats per minute?

(1)  $-0.999$

(3)  $0.998$

(2)  $-0.664$

(4)  $1.503$

Use this space for computations.

26 In  $\triangle MNP$ ,  $m = 6$  and  $n = 10$ . Two distinct triangles can be constructed if the measure of angle  $M$  is

(1) 35

(2) 40

(3) 45

(4) 50

$$\frac{6}{\sin 35} = \frac{10}{\sin N}$$

$$N = 73^\circ \text{ or } 107^\circ$$
$$\begin{array}{r} 35 \\ \hline 108^\circ \end{array} \qquad \begin{array}{r} 35 \\ \hline 142^\circ \end{array}$$

27 If order does *not* matter, which selection of students would produce the most possible committees?

(1) 5 out of 15  ${}_{15}C_5 = 3,003$

(2) 5 out of 25

(3) 20 out of 25  ${}_{25}C_{20} = 53,730$

(4) 15 out of 25

$${}_{25}C_5 = 53,130$$

$${}_{25}C_{15} = 3,268,760$$

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Part II

Answer all 8 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. [16]

28 Determine the value of  $n$  in simplest form:

$$i^{13} + i^{18} + i^{31} + n = 0$$

$$i + i^2 + i^3 + n = 0$$

$$i + -1 - i + n = 0$$

$$-1 + n = 0$$

$$n = 1$$

**29** The formula for continuously compounded interest is  $A = Pe^{rt}$ , where  $A$  is the amount of money in the account,  $P$  is the initial investment,  $r$  is the interest rate, and  $t$  is the time in years.

Using the formula, determine, to the *nearest dollar*, the amount in the account after 8 years if \$750 is invested at an annual rate of 3%.

$$A = 750e^{(0.03)(8)} \approx 953$$

30 Express  $\cos \theta (\sec \theta - \cos \theta)$ , in terms of  $\sin \theta$ .

$$\cos \theta \cdot \frac{1}{\cos \theta} - \cos^2 \theta$$

$$1 - \cos^2 \theta$$

$$\sin^2 \theta$$

- 31 A cup of soup is left on a countertop to cool. The table below gives the temperatures, in degrees Fahrenheit, of the soup recorded over a 10-minute period.

Time in Minutes ( $x$ )	0	2	4	6	8	10
Temperature in °F ( $y$ )	180.2	165.8	146.3	135.4	127.7	110.5

Write an exponential regression equation for the data, rounding all values to the *nearest thousandth*.

$$y = 180.377(0.954)^x$$

- 32 Find, to the *nearest tenth*, the radian measure of  $216^\circ$ .

$$216 \cdot \frac{\pi}{180} \approx 3.8$$

**33** Find the third term in the recursive sequence  $a_{k+1} = 2a_k - 1$ , where  $a_1 = 3$ .

$$a_1 = 3$$

$$a_2 = 2(3) - 1 = 5$$

$$a_3 = 2(5) - 1 = 9$$

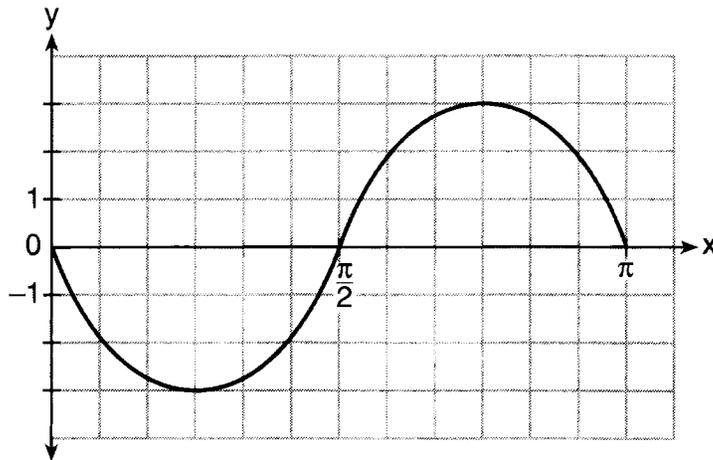
34 The two sides and included angle of a parallelogram are 18, 22, and  $60^\circ$ . Find its exact area in simplest form.

$$A = 18 \cdot 22 \cdot \sin 60$$

$$= 396 \frac{\sqrt{3}}{2}$$

$$= 198\sqrt{3}$$

35 Write an equation for the graph of the trigonometric function shown below.



$$y = -3 \sin 2x$$

Part III

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]

36 Express in simplest form:  $\frac{4 - x^2}{x^2 + 7x + 12} \cdot \frac{2x - 4}{x + 3}$

$$\frac{-(2+x)(\cancel{2-x})}{(x+4)(\cancel{2+3})} \cdot \frac{\cancel{x+3}}{2(\cancel{x-2})}$$

$$\frac{-(x+2)}{2(x+4)}$$

37 During a particular month, a local company surveyed all its employees to determine their travel times to work, in minutes. The data for all 15 employees are shown below.

25	55	40	65	29
45	59	35	25	37
52	30	8	40	55

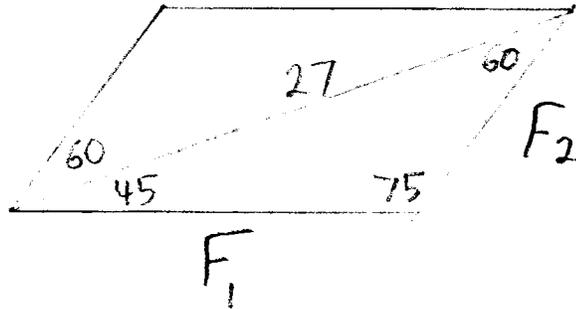
8

Determine the number of employees whose travel time is within one standard deviation of the mean.

$$\sigma_x = 14.9 \quad \bar{x} = 40$$

$$25.1 \longleftrightarrow 54.9$$

- 38 The measures of the angles between the resultant and two applied forces are  $60^\circ$  and  $45^\circ$ , and the magnitude of the resultant is 27 pounds. Find, to the *nearest pound*, the magnitude of each applied force.



$$\frac{27}{\sin 75} = \frac{F_1}{\sin 60}$$

$$F_1 \approx 24$$

$$\frac{27}{\sin 75} = \frac{F_2}{\sin 45}$$

$$F_2 \approx 20$$

Part IV

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. A correct numerical answer with no work shown will receive only 1 credit. The answer should be written in pen. [6]

39 Solve algebraically for all values of  $x$ :

$$81x^3 + 2x^2 = 27 \frac{5x}{3}$$

$$(3^4)x^3 + 2x^2 = (3^3) \frac{5x}{3}$$

$$3 \{ 4x^3 + 8x^2 = \} 5x$$

$$4x^3 + 8x^2 = 5x$$

$$4x^3 + 8x^2 - 5x = 0$$

$$x(4x^2 + 8x - 5) = 0$$

$$x(2x - 1)(2x + 5) = 0$$

$$x = 0 \quad 2x - 1 = 0 \quad 2x + 5 = 0$$

$$x = \frac{1}{2}$$

$$x = -\frac{5}{2}$$