

ALGEBRA 2/TRIGONOMETRY

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

ALGEBRA 2/TRIGONOMETRY

Wednesday, August 18, 2010—8:30 to 11:30 a.m., only

Student Name: Mr. Sibol

School Name: HS For Civil Rights

Print your name and the name of your school on the lines 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.

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]

Use this space for computations.

1 The product of $(3 + \sqrt{5})$ and $(3 - \sqrt{5})$ is

- (1) $4 - 6\sqrt{5}$ (3) 14
 (2) $14 - 6\sqrt{5}$ (4) 4

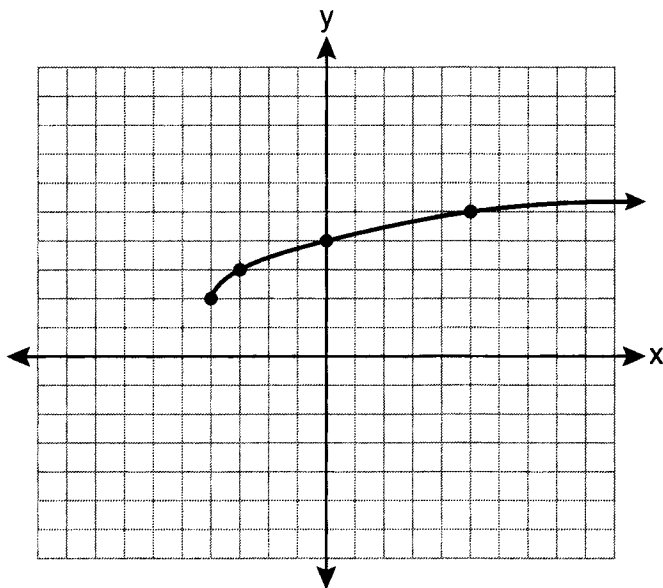
Because the binomials are conjugates, use FL
 $9 - 5 = 4$

2 What is the radian measure of an angle whose measure is -420° ?

- (1) $-\frac{7\pi}{3}$ (3) $\frac{7\pi}{6}$
 (2) $-\frac{7\pi}{6}$ (4) $\frac{7\pi}{3}$

$$-420 \cdot \frac{\pi}{180} = -\frac{7\pi}{3}$$

3 What are the domain and the range of the function shown in the graph below?



- (1) $\{x \mid x > -4\}; \{y \mid y > 2\}$ (3) $\{x \mid x > 2\}; \{y \mid y > -4\}$
 (2) $\{x \mid x \geq -4\}; \{y \mid y \geq -2\}$ (4) $\{x \mid x \geq 2\}; \{y \mid y \geq -4\}$

Use this space for computations.

4 The expression $2i^2 + 3i^3$ is equivalent to

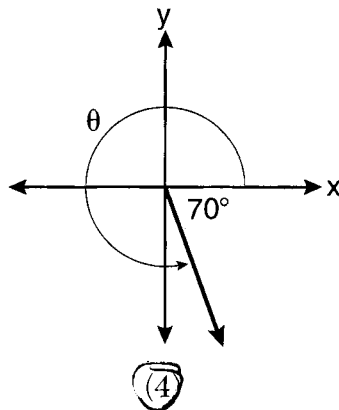
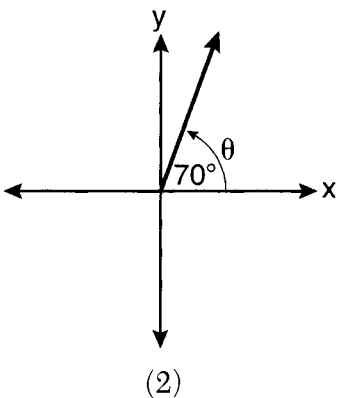
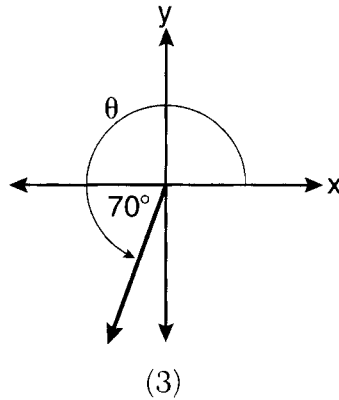
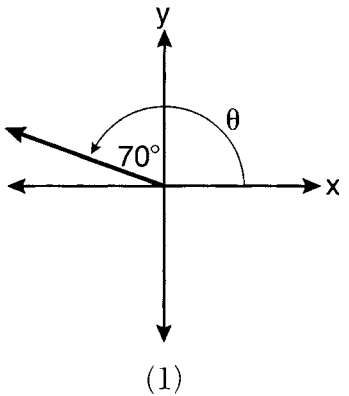
- (1) $-2 - 3i$ (3) $-2 + 3i$
 (2) $2 - 3i$ (4) $2 + 3i$

$$2i^2 + 3i^3$$

$$2(-1) + 3(-i)$$

$$-2 - 3i$$

5 In which graph is θ coterminal with an angle of -70° ?



6 In $\triangle ABC$, $m\angle A = 74$, $a = 59.2$, and $c = 60.3$. What are the two possible values for $m\angle C$, to the nearest tenth?

- (1) 73.7 and 106.3 (3) 78.3 and 101.7
 (2) 73.7 and 163.7 (4) 78.3 and 168.3

Law of Sines

$$\frac{59.2}{\sin 74} = \frac{60.3}{\sin C}$$

$$C \approx 78.3$$

$$\frac{180}{78.3}$$

$$\frac{101.7}{101.7}$$

Use this space for computations.

7 What is the principal value of $\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$?

(1) -30°

(3) 150°

(2) 60°

(4) 240°

8 What is the value of x in the equation $9^{3x+1} = 27^{x+2}$?

(1) 1

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

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

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

$$(3^2)^{3x+1} = (3^3)^{x+2}$$

$$3^{6x+2} = 3^{3x+6}$$

$$6x+2 = 3x+6$$

$$3x = 4$$

$$\frac{-7 \pm \sqrt{7^2 - 4(2)(-3)}}{2(2)}$$

$$\frac{-7 \pm \sqrt{73}}{4}$$

9 The roots of the equation $2x^2 + 7x - 3 = 0$ are

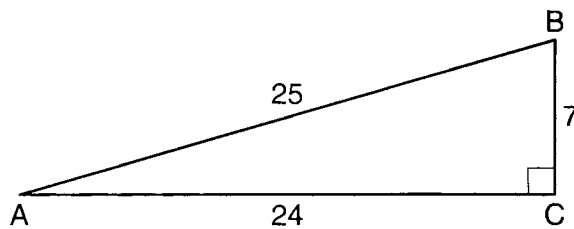
(1) $-\frac{1}{2}$ and -3

(3) $\frac{-7 \pm \sqrt{73}}{4}$

(2) $\frac{1}{2}$ and 3

(4) $\frac{7 \pm \sqrt{73}}{4}$

10 Which ratio represents $\csc A$ in the diagram below?



(1) $\frac{25}{24}$

(3) $\frac{24}{7}$

(2) $\frac{25}{7}$

(4) $\frac{7}{24}$

$$\sin A = \frac{7}{25}$$

$$\csc A = \frac{25}{7}$$

Use this space for computations.

11 When simplified, the expression $\left(\frac{w^{-5}}{w^{-9}}\right)^{\frac{1}{2}}$ is equivalent to

(1) w^{-7}

(2) w^2

(3) w^7

(4) w^{14}

$$\left(w^4\right)^{\frac{1}{2}}$$
$$w^2$$

12 The principal would like to assemble a committee of 8 students from the 15-member student council. How many different committees can be chosen?

(1) 120

(2) 6,435

(3) 32,432,400

(4) 259,459,200

$${}_{15}C_8 = 6435$$

13 An amateur bowler calculated his bowling average for the season. If the data are normally distributed, about how many of his 50 games were within one standard deviation of the mean?

(1) 14

(2) 17

(3) 34

(4) 48

$$68\% \times 50 = 34$$

14 What is a formula for the n th term of sequence B shown below?

$$B = 10, 12, 14, 16, \dots$$

(1) $b_n = 8 + 2n$

(2) $b_n = 10 + 2n$

(3) $b_n = 10(2)^n$

(4) $b_n = 10(2)^{n-1}$

common difference = 2

$$b_n = x + 2n$$

$$10 = x + 2(1)$$

$$8 = x$$

Use this space for computations.

15 Which values of x are in the solution set of the following system of equations?

$$y = 3x - 6$$

$$y = x^2 - x - 6$$

- (1) 0, -4
 (2) 0, 4
 (3) 6, -2
 (4) -6, 2

$$x^2 - x - 6 = 3x - 6$$

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

$$x(x-4) = 0$$

$$x = 0 \quad x = 4$$

16 The roots of the equation $9x^2 + 3x - 4 = 0$ are

- (1) imaginary
 (2) real, rational, and equal
 (3) real, rational, and unequal
 (4) real, irrational, and unequal

$$b^2 - 4ac$$

$$3^2 - 4(9)(-4)$$

$$9 + 144 = 153$$

17 In $\triangle ABC$, $a = 3$, $b = 5$, and $c = 7$. What is $m\angle C$?

- (1) 22
 (2) 38
 (3) 60
 (4) 120

$$7^2 = 3^2 + 5^2 - 2(3)(5)\cos A$$

$$49 = 34 - 30\cos A$$

$$15 = -30\cos A$$

$$\frac{15}{-30} = \frac{-30\cos A}{-30}$$

$$-\frac{1}{2} = \cos A$$

$$120 = A$$

18 When $x^{-1} - 1$ is divided by $x - 1$, the quotient is

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

$$\frac{x^{-1} - 1}{x - 1} = \frac{\frac{1}{x} - 1}{x - 1} = \frac{\frac{1-x}{x} - 1}{x - 1} = -\frac{1}{x}$$

Use this space for computations.

19 The fraction $\frac{3}{\sqrt{3a^2b}}$ is equivalent to

(1) $\frac{1}{a\sqrt{b}}$

(2) $\frac{\sqrt{b}}{ab}$

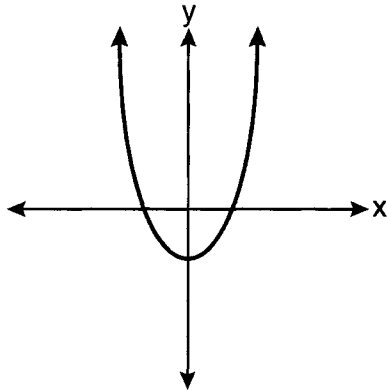
(3) $\frac{\sqrt{3b}}{ab}$

(4) $\frac{\sqrt{3}}{a}$

$$\frac{3}{\sqrt{3a^2b}} = \frac{3}{a\sqrt{3b}} \cdot \frac{\sqrt{3b}}{\sqrt{3b}} = \frac{3\sqrt{3b}}{3ab}$$

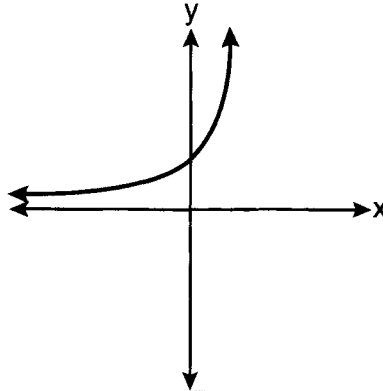
$$\frac{\sqrt{3b}}{ab}$$

20 Which graph represents a one-to-one function?

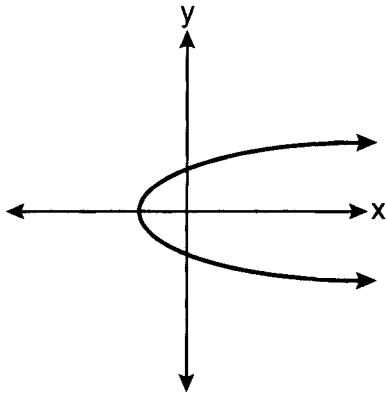


(1)

Fails horizontal line test

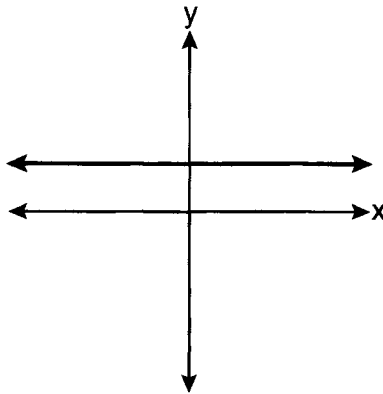


(3)



(2)

not a function



(4)

Fails horizontal line test

Use this space for computations.

21 The sides of a parallelogram measure 10 cm and 18 cm. One angle of the parallelogram measures 46 degrees. What is the area of the parallelogram, to the nearest square centimeter?

- (1) 65
- (2) 125

- (3) 129
- (4) 162

$$K = (10)(18) \sin 46$$
$$\approx 129$$

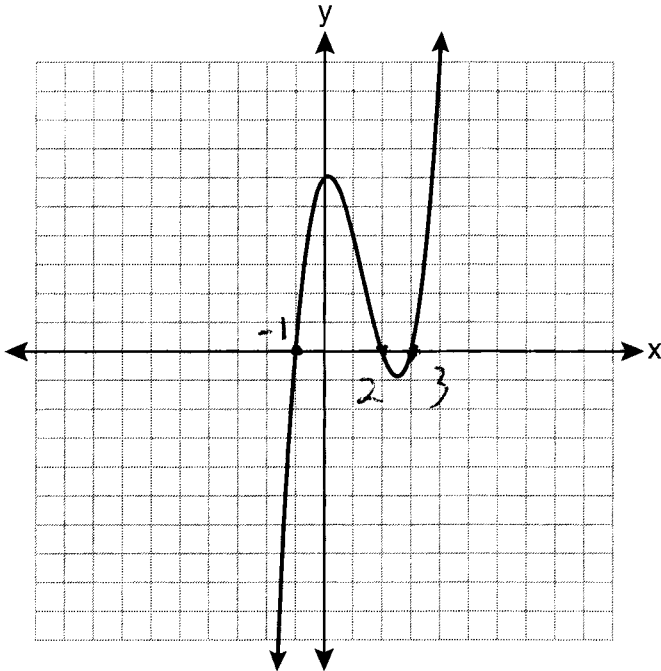
22 The minimum point on the graph of the equation $y = f(x)$ is $(-1, -3)$. What is the minimum point on the graph of the equation $y = f(x) + 5$?

- (1) $(-1, 2)$
- (2) $(-1, -8)$

- (3) $(4, -3)$
- (4) $(-6, -3)$

$$-3 + 5 = 2$$

23 The graph of $y = x^3 - 4x^2 + x + 6$ is shown below.



What is the product of the roots of the equation $x^3 - 4x^2 + x + 6 = 0$?

- (1) -36
- (2) -6

- (3) 6
- (4) 4

Use this space for computations.

24 What is the conjugate of $-2 + 3i$?

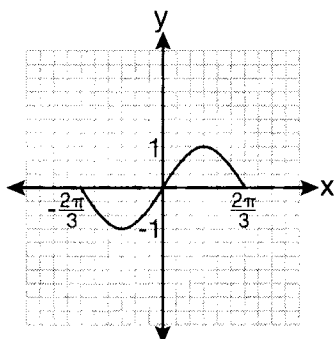
- (1) $-3 + 2i$ (3) $2 - 3i$
 (2) $-2 - 3i$ (4) $3 + 2i$

25 What is the common ratio of the geometric sequence whose first term is 27 and fourth term is 64?

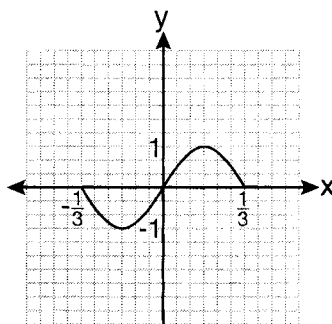
- (1) $\frac{3}{4}$ (3) $\frac{4}{3}$
 (2) $\frac{64}{81}$ (4) $\frac{37}{3}$

$$\frac{27r^3 = 64}{27} \quad \frac{r^3 = \frac{64}{27}}{r = \sqrt[3]{\frac{64}{27}} = \frac{4}{3}}$$

26 Which graph represents one complete cycle of the equation $y = \sin 3\pi x$?

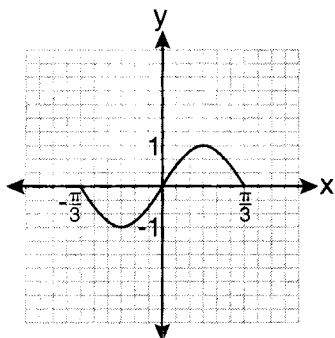


(1)

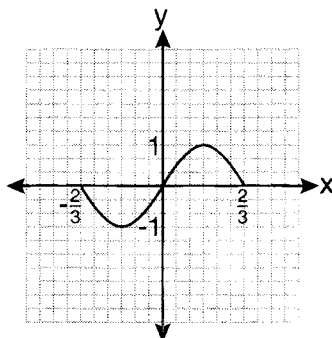


(3)

$$\begin{aligned} \text{period} &= \frac{2\pi}{b} \\ &= \frac{2\pi}{3\pi} \\ &= \frac{2}{3} \end{aligned}$$



(2)



(4)

Use this space for
computations.

27 Which two functions are inverse functions of each other?

(1) $f(x) = \sin x$ and $g(x) = \cos x$

(2) $f(x) = 3 + 8x$ and $g(x) = 3 - 8x$

(3) $f(x) = e^x$ and $g(x) = \ln x$

(4) $f(x) = 2x - 4$ and $g(x) = -\frac{1}{2}x + 4$

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 Factor completely: $10ax^2 - 23ax - 5a$

$$a(10x^2 - 23x - 5)$$

$$a(5x+1)(2x-5)$$

29 Express the sum $7 + 14 + 21 + 28 + \dots + 105$ using sigma notation.

$$\sum_{n=1}^{15} 7n$$

30 Howard collected fish eggs from a pond behind his house so he could determine whether sunlight had an effect on how many of the eggs hatched. After he collected the eggs, he divided them into two tanks. He put both tanks outside near the pond, and he covered one of the tanks with a box to block out all sunlight.

State whether Howard's investigation was an example of a controlled experiment, an observation, or a survey. Justify your response.

Controlled experiment because Howard is comparing the results obtained from an experimental sample against a control sample.

- 31 The table below shows the number of new stores in a coffee shop chain that opened during the years 1986 through 1994.

Year	Number of New Stores
1986	14
1987	27
1988	48
1989	80
1990	110
1991	153
1992	261
1993	403
1994	681

Using $x = 1$ to represent the year 1986 and y to represent the number of new stores, write the exponential regression equation for these data. Round all values to the *nearest thousandth*.

$$y = 10.596(1.586)^x$$

32 Solve the equation $2 \tan C - 3 = 3 \tan C - 4$ algebraically for all values of C in the interval $0^\circ \leq C < 360^\circ$.

$$1 = \tan C$$

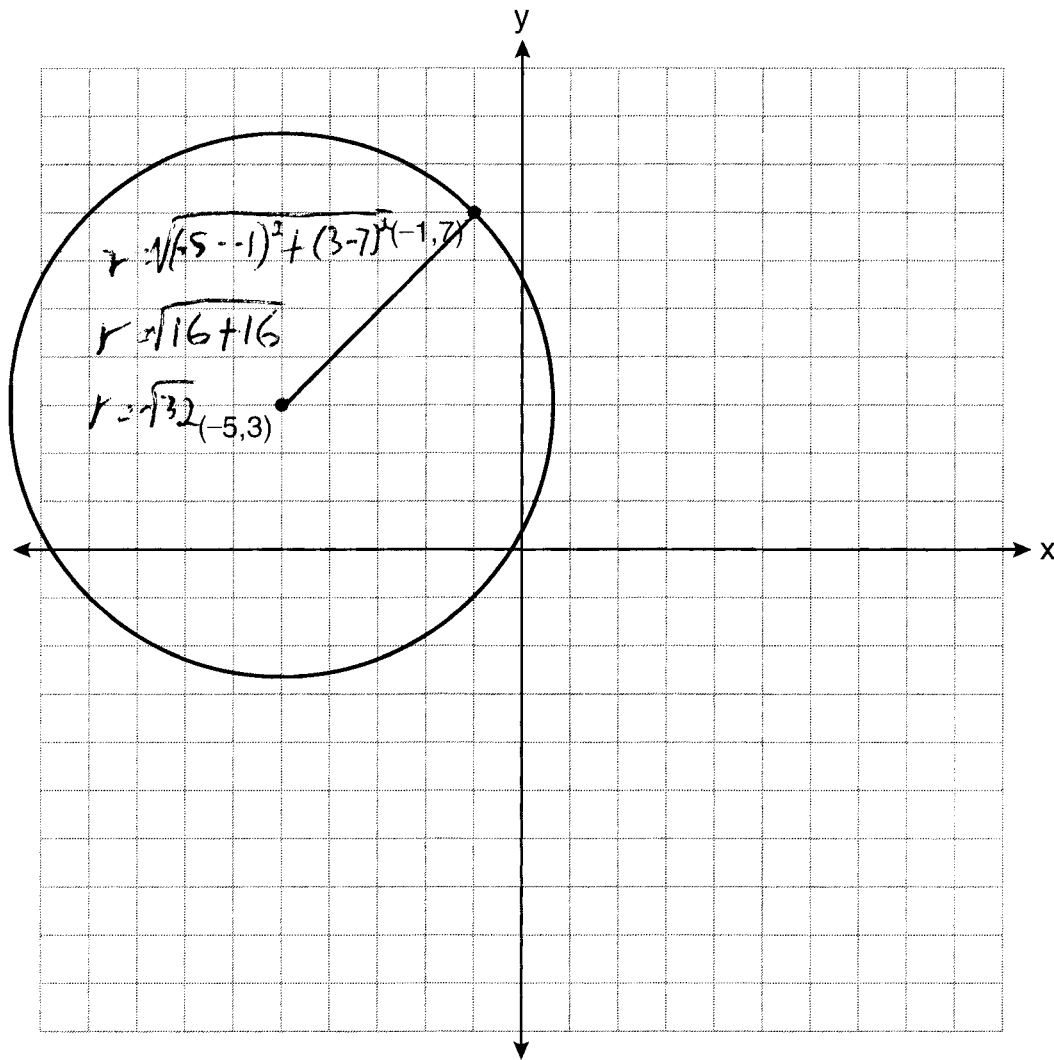
$$C = \tan^{-1} 1$$

$$C = 45^\circ$$

$$+ 180^\circ$$

$$\hline 225^\circ$$

33 A circle shown in the diagram below has a center of $(-5,3)$ and passes through point $(-1,7)$.



Write an equation that represents the circle.

$$(x + 5)^2 + (y - 3)^2 = 32$$

34 Express $\left(\frac{2}{3}x - 1\right)^2$ as a trinomial.

$$\left(\frac{2}{3}x - 1\right)\left(\frac{2}{3}x - 1\right)$$

$$\frac{4}{9}x^2 - \frac{2}{3}x - \frac{2}{3}x + 1$$

$$\frac{4}{9}x^2 - \frac{4}{3}x + 1$$

35 Find the total number of different twelve-letter arrangements that can be formed using the letters in the word *PENNSYLVANIA*.

$$\frac{{}^{12}P_{12}}{3! \cdot 2!} = 39,916,800$$

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 Solve algebraically for x : $\frac{1}{x+3} - \frac{2}{3-x} = \frac{4}{x^2-9}$

$$\frac{1}{x+3} + \frac{2}{x-3} = \frac{4}{x^2-9}$$

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

$$x-3 + 2x+6 = 4$$

$$3x = 1$$

$$x = \frac{1}{3}$$

37 If $\tan A = \frac{2}{3}$ and $\sin B = \frac{5}{\sqrt{41}}$ and angles A and B are in Quadrant I, find the value of $\tan(A + B)$.

$$\cos^2 B + \sin^2 B = 1$$

$$\cos^2 B + \left(\frac{5}{\sqrt{41}}\right)^2 = 1$$

$$\cos^2 B + \frac{25}{41} = \frac{41}{41}$$

$$\cos^2 B = \frac{16}{41}$$

$$\cos B = \frac{4}{\sqrt{41}}$$

$$\tan B = \frac{\sin B}{\cos B} = \frac{\frac{5}{\sqrt{41}}}{\frac{4}{\sqrt{41}}} = \frac{5}{4}$$

$$\tan(A+B) = \frac{\frac{2}{3} + \frac{5}{4}}{1 - \left(\frac{2}{3}\right)\left(\frac{5}{4}\right)}$$

$$= \frac{\frac{8+15}{12}}{1 - \frac{10}{12}} = \frac{\frac{23}{12}}{\frac{2}{12}} = \frac{23}{2}$$

38 A study shows that 35% of the fish caught in a local lake had high levels of mercury. Suppose that 10 fish were caught from this lake. Find, to the *nearest tenth of a percent*, the probability that *at least 8* of the 10 fish caught did *not* contain high levels of mercury.

$$n C_r p^r q^{n-r}$$

$$p = .65$$

$$q = .35$$

$$n = 10$$

$$r = 8, 9, 10$$

$${}_{10}C_8 \cdot .65^8 \cdot .35^2 = .17565$$

$${}_{10}C_9 \cdot .65^9 \cdot .35^1 = .07249$$

$${}_{10}C_{10} \cdot .65^{10} \cdot .35^0 = .01346$$

$$.26160$$

$$26.2\%$$

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 x : $\log_{x+3} \frac{x^3+x-2}{x} = 2$

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

$$\frac{x^3+x-2}{x} = x^2+6x+9$$

$$x^3+x-2 = x^3+6x^2+9x$$

$$0 = 6x^2+8x+2$$

$$0 = 3x^2+4x+1$$

$$0 = (3x+1)(x+1)$$

$$x = -\frac{1}{3} \quad x = -1$$