Part I

Answer 30 questions from this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Write your answers in the spaces provided on the separate answer sheet. Where applicable, answers may be left in terms of π or in radical form.

1 Express 144° in radian measure.

2 What is the amplitude of the graph of $y = 3 \cos 2x$?

3 Solve for x: $\frac{1}{x} + 1 = \frac{3}{2x}$

4 Given: circle O with $\overline{QR}$ tangent to the circle at R. If $m\angle OQR = 20$, find $m\angle ROQ$.

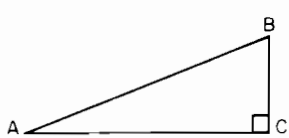
5 Find cos (Arc tan 1).

6 In a circle, a central angle of 2 radians intercepts an arc of length 12. Find the length of the radius of the circle.

7 If $f(x) = \log (x^2)$, find $f(10)$.

8 Express $(3 - 2i)^2$ in the form $a + bi$.

9 In the accompanying diagram of right triangle ABC, $AB = 5000$ and $m\angle C = 90$. If the measure of angle A is 20° 40′, find AC to the *nearest unit*.



10 Find the value of $16^{\frac{3}{4}}$.

11 Evaluate: $\sum_{n=3}^{5} (2n + 3)$

12 In $\triangle RST$, $r = 3$, $s = 3\sqrt{2}$, and $m\angle R = 30$. Find $m\angle S$ if S is an acute angle.

13 In circle O, chords $\overline{AB}$ and $\overline{CD}$ intersect at E. If $AE = 6$, $BE = 12$, and $CE = 8$, find DE.

14 Solve for x: $\sqrt{2x + 3} - 5 = 0$

15 If $\cos x = \frac{3}{5}$ and x is a positive acute angle, find $\tan \frac{1}{2}x$.

16 What value of x satisfies the equation $\sin x \cos x - 2 \cos x = 0$ for $0° < x < 180°$?

17 If $\sin x = \frac{5}{6}$, what is the value of $\cos 2x$?

18 Team A and team B play 3 games. If team A's probability of winning a game is $\frac{2}{5}$, what is the probability of team A winning at least two games?

19 Find the value of $\tan x$ if $\cos x = \frac{3}{5}$ and $\sin x < 0$.

20 What is the image of the point $(5, -2)$ under the translation $T_{2,1}$?

Directions (21–35): For *each* question chosen, write on the separate answer sheet the *numeral* preceding the word or expression that best completes the statement or answers the question.

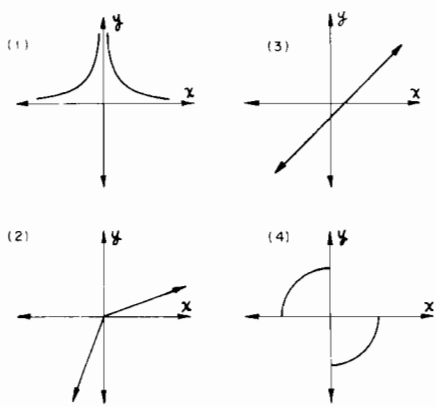
21 A dilation is a transformation that does *not* preserve

(1) distance
(2) similarity
(3) orientation
(4) betweenness

22 As angle x increases from 90° to 180°, the value of sin x

(1) increases from -1 to 0
(2) increases from 0 to 1
(3) decreases from 0 to -1
(4) decreases from 1 to 0

23 Which figure has line symmetry with respect to the line $x = 0$?



24 The expression $\log \sqrt[3]{\frac{a}{b}}$ is equivalent to

(1) $\frac{1}{3}(\log a - \log b)$
(2) $\frac{1}{3} \log a + \log b$
(3) $\frac{1}{3}\left(\frac{\log a}{\log b}\right)$
(4) $3(\log a - \log b)$

25 In $\triangle ABC$, if $a = 4$, $b = 9$, and $c = 8$, then $\cos A$ equals

(1) 1 (2) $\frac{43}{48}$ (3) $\frac{161}{144}$ (4) $\frac{48}{43}$

26 If $a = 5$, $b = 7$, and $m\angle A = 30$, how many distinct triangles can be constructed?

(1) 1 (2) 2 (3) 3 (4) 4

27 A transformation maps (1,3) onto (−1,−3). This transformation is equivalent to

(1) rotation $R_{90°}$ (3) dilation D_{-1}

(2) rotation $R_{-90°}$ (4) translation $T_{-1,-3}$

28 If $a > b$ and $c < 0$, then which statement is true?

(1) $a + c < b + c$ (3) $ac > bc$
(2) $a - c < b - c$ (4) $ac < bc$

29 The expression $\sin(\theta + 270°)$ equals

(1) $\cos \theta$ (3) $-\cos \theta$
(2) $2 \cos \theta$ (4) $-\sin \theta$

30 If the roots of the equation $ax^2 + bx + c = 0$ are imaginary, the graph of the equation will

(1) intersect the x-axis at two points
(2) not intersect the y-axis
(3) not intersect the x-axis
(4) be tangent to the x-axis

31 The expression $\frac{5}{4 - 3i}$ is equivalent to

(1) $\frac{20 + 15i}{7}$ (3) $\frac{20 - 15i}{7}$

(2) $\frac{4 + 3i}{5}$ (4) $\frac{7i}{5}$

32 If $\tan x = -\frac{\sqrt{3}}{3}$, in which quadrant(s) may angle x terminate?

(1) II and III (3) III, only
(2) II, only (4) II and IV

33 What is the numerical coefficient of the second term of the expansion $(x - 2y)^4$?

(1) -8 (3) 24
(2) 8 (4) -32

34 On a standardized test, the mean was 75 and the standard deviation was 4.0. Approximately what percentage of the scores would fall within the range 71 to 79?

(1) 34% (3) 95%
(2) 68% (4) 99%

35 What is the inverse relation of the function whose equation is $y = 2x + 3$?

(1) $y = 2x - 3$ (3) $y = 3x - 2$

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

Part II

Answer four questions from this part. Show all work unless otherwise directed.

36 *a* On the same set of axes, sketch and label the graphs of $y = 2 \sin x$ and $y = \cos 2x$ as x varies from 0 to 2π radians. [8]

b How many values of x in the interval $0 \leq x \leq 2\pi$ satisfy the equation $2 \sin x = \cos 2x$? [2]

37 *a* Find all values of θ in the interval $0° \leq \theta \leq 360°$ which satisfy the equation $2 \cos^3 \theta + \cos^2 \theta - \cos \theta = 0$. [6]

b For all values of θ for which the expressions are defined, prove the following identity:

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

[4]

38 *a* Solve the equation $3x^2 + 3 = 5x$ and express its roots in terms of i. [5]

b Using logarithms, solve for x to the *nearest tenth:*

$$3^{2x} = 5$$ [5]

39 The shoe sizes of the ten players on a basketball team are as follows: 7, 8, 9½, 10, 10, 10, 10½, 11, 11, 13. Determine the standard deviation of these shoe sizes to the *nearest tenth.* [10]

40 *a* In $\triangle ABC$, $a = 11$, $b = 20$, and $m\angle B = 42° 30'$. Find the measure of angle A to the *nearest ten minutes.* [5]

b Using the result obtained in part *a*, find the area of $\triangle ABC$ to the *nearest square unit.* [5]

41 *a* On graph paper, draw and label $\triangle ABC$ whose coordinates are $A(2,1)$, $B(6,4)$, and $C(8,1)$. [1]

b Graph and state the coordinates of $\triangle A'B'C'$, the reflection of $\triangle ABC$ through the x-axis. [3]

c Graph and state the coordinates of $\triangle A''B''C''$, the image of $\triangle A'B'C'$ after the translation $T_{-6,-2}$. [3]

d Using the origin as the center of rotation, graph and state the coordinates of $\triangle A'''B'''C'''$, the result of rotating $\triangle A''B''C''$ 90° clockwise. [3]

42 In the accompanying figure, quadrilateral $MNPQ$ is inscribed in circle O with $\overline{ST}$ tangent to the circle at P. Diagonals $\overline{PM}$ and $\overline{QN}$ intersect at K and $m\overset{\frown}{MN}:m\overset{\frown}{NP}:m\overset{\frown}{PQ}:m\overset{\frown}{QM} = 5:3:8:4$.

Find: *a* $m\overset{\frown}{MN}$ [3]

b $m\angle MQP$ [2]

c $m\angle SPQ$ [3]

d $m\angle PKQ$ [2]