Part I

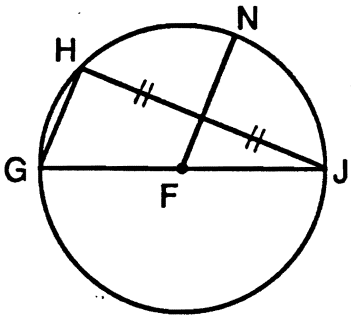
Answer 30 questions from this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Write your answers in the spaces provided on the separate answer sheet. Where applicable, answers may be left in terms of π or in radical form. [60]

1 Express $\frac{2\pi}{3}$ radians in degrees.

2 Evaluate: $\sum_{n=1}^{4} (n\sqrt{2})$

3 Express $\frac{5}{\sqrt{3}-1}$ as an equivalent fraction with a rational denominator.

4 In the accompanying diagram of circle F, $\overline{FN}$ bisects $\overline{HJ}$ and $m\widehat{NJ} = 68$. Find $m\widehat{HG}$.



5 In $\triangle ABC$, $b = 3$, $c = 4$, and $\angle A = 45°$. Expressed in simplest radical form, what is the area of $\triangle ABC$?

6 The rate at which a man travels from City A to City B varies inversely as the time it takes to make the trip. If the man can make the trip in $3\frac{1}{2}$ hours at 60 kilometers per hour, how many kilometers per hour must he travel to make the trip in 3 hours?

7 Solve for x: $4^{3x} = 8^{x+1}$

8 What is the image of $R_{-180°}$ $(-4,-7)$?

9 Two secants, $\overline{ABC}$ and $\overline{ADE}$, are drawn to a circle from external point A. If $AB = 4$, $BC = 6$, and $AD = 5$, find DE.

10 In $\triangle ABC$, if $\sin A = \frac{4}{5}$, $\sin B = \frac{3}{8}$, and $a = 24$, find b.

11 Express the product $(3 - i)(4 + i)$ in the form $a + bi$.

12 Find a value of θ in the interval $0° \leq \theta < 360°$ that satisfies the equation $\sin^2\theta - \sin\theta - 2 = 0$.

13 If $f(x) = 3x$ and $g(x) = 7x - 1$, what is $(f \circ g)(4)$?

14 Express as a single fraction in lowest terms:

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

15 Find the value of x: $\log_3 (x - 2) = 2$

Directions (16–35): 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.

16 For all values of A for which the expression is defined, $\frac{\cot A}{\csc A}$ is equivalent to

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

17 On a standardized test with a normal distribution of scores, the mean score is 150 and the standard deviation is 18. Which interval will contain 68% of the scores?

(1) 141–159
(2) 150–168
(3) 132–168
(4) 132–150

18 What is the amplitude of the graph whose equation is $y = -4 \sin 2x$?

(1) π (3) -2
(2) 2 (4) 4

19 The value of $\tan\left(\text{Arc}\cos\frac{\sqrt{2}}{2}\right)$ is

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

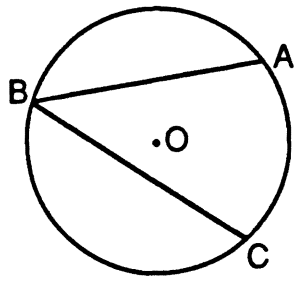
20 What is the solution set for the equation $2x - |x + 3| = 9$?

(1) {12} (3) {2,12}
(2) {2} (4) { }

21 The domain for $g(x) = 5x - 1$ is $-2 \leq x \leq 2$. The *smallest* value in the range of $g(x)$ is

(1) -11 (3) 11
(2) 9 (4) -9

22 In the accompanying figure of circle O, the measure of $\overset{\frown}{AC}$ is 84°. What is the measure of $\angle ABC$?

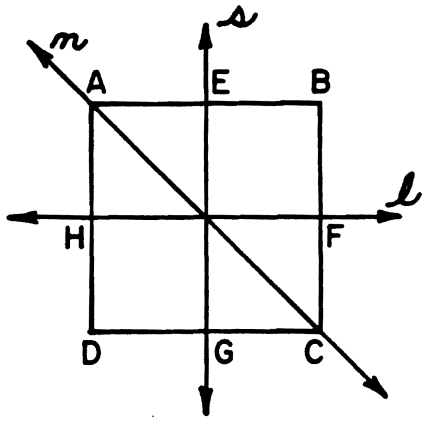


(1) 21° (3) 84°
(2) 42° (4) 168°

23 If $x = \frac{\sqrt{r}}{s}$, which expression is equivalent to $\log x$?

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

24 In the accompanying diagram, $ABCD$ is a square with symmetry lines n, s, and ℓ. What is $r_n \circ r_s(\overline{BF})$?



(1) $\overline{FC}$ (3) $\overline{GC}$
(2) $\overline{AE}$ (4) $\overline{EB}$

25 A fair coin is tossed ten times and a head appears each time. What is the probability that on the next three tosses of the coin, exactly two heads will appear?

(1) $\frac{5}{10}$ (3) $\frac{3}{8}$
(2) $\frac{2}{8}$ (4) $\frac{1}{10}$

26 Which expression is equivalent to cos 150°?

(1) cos 60° (3) cos 30°
(2) $-\cos 60°$ (4) $-\cos 30°$

27 For which value of x is $\tan(x + 20°)$ undefined?

(1) $-20°$ (3) 160°
(2) 70° (4) 340°

28 If $\sin A = \frac{3}{5}$, $\sin B = \frac{2}{3}$, and $\angle A$ and $\angle B$ are acute angles, what is the value of $\cos(A - B)$?

(1) $-\frac{2}{3}$ (3) $\frac{4\sqrt{5} + 2}{5}$
(2) $\frac{4\sqrt{5} - 6}{15}$ (4) $\frac{4\sqrt{5} + 6}{15}$

29 The graph of the equation $4x^2 + 16y^2 = 25$ is

(1) a circle (3) an ellipse
(2) a hyperbola (4) a parabola

30 If $m\angle A = 48$, $a = 7$, and $b = 9$, the number of distinct triangles that can be constructed is

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

31 If $\cos(2x + 10)^\circ = \sin(x + 20)^\circ$, a value of x is

(1) 20 (3) 40
(2) 30 (4) 60

32 What is the solution set of the inequality $x^2 - 6x - 7 > 0$?

(1) $\{x|-1 < x < 7\}$
(2) $\{x|x = -1 \text{ or } x = 7\}$
(3) $\{x|x < -7 \text{ or } x > 1\}$
(4) $\{x|x > 7 \text{ or } x < -1\}$

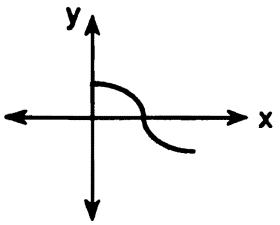
33 If $f(x) = \cos\frac{x}{3} + \sin x$, then $f(\pi)$ equals

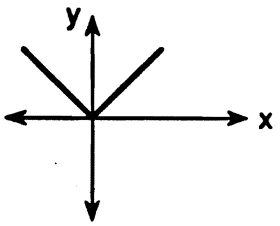
(1) $1\frac{1}{2}$ (3) $-\frac{1}{2}$
(2) $\frac{1}{2}$ (4) $\frac{\sqrt{3}}{2}$

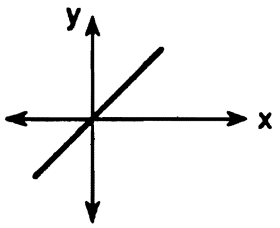
34 What is the sum of the roots of the equation $3x^2 = 9x + 1$?

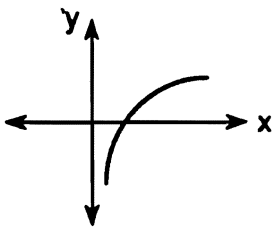
(1) $\frac{1}{3}$ (3) 3
(2) -3 (4) 9

35 Which function is *not* one to one?

(1)


(2)


(3)


(4)


Answers to the following questions are to be written on paper provided by the school.

Part II

Answer four questions from this part. All work, including calculations, must be shown on your answer paper. [40]

36 *a* On the same set of axes, sketch the graphs of the equations $y = \cos 2x$ and $y = \tan x$ in the domain $-\pi \leq x \leq \pi$. [8]

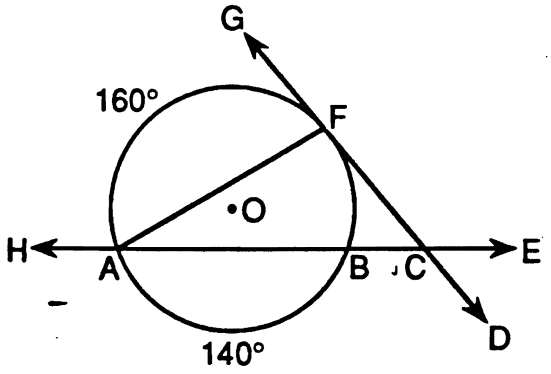
b What is a line of symmetry of the graph of $y = \cos 2x$ as sketched in part *a*? [2]

37 *a* Find all values of θ in the interval $0° \leq \theta < 360°$ that satisfy the equation $\cos 2\theta - \cos \theta = 0$. [5]

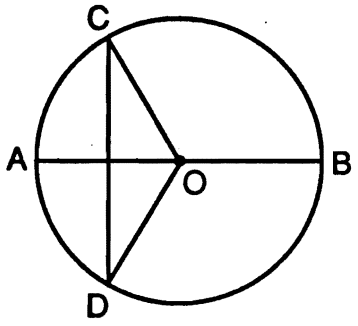
b For all values of θ for which the expressions are defined, prove that the following is an identity:

$$\frac{2 \sin^2 \theta}{\sin 2\theta} + \frac{1}{\tan \theta} = \sec \theta \csc \theta \quad [5]$$

38 In the accompanying diagram, $\overleftrightarrow{DCFG}$ is tangent to circle O at F, $\overleftrightarrow{ECH}$ is a secant intersecting the circle at A and B, $m\overset{\frown}{AB} = 140$ and $m\overset{\frown}{AF} = 160$. If $FC = 10$, find AF to the *nearest tenth*. [10]



39 In the accompanying diagram of circle O, diameter $\overline{AB}$ is perpendicular to chord $\overline{CD}$ and $m\angle AOC = 60$. A fair spinner is placed at O.



Determine the probability that the spinner lands in region

a *BOC* in one spin [2]

b *AOD* in one spin [2]

c *BOC at least* twice in three spins [3]

d *AOC at most* once in three spins [3]

40 *a* Solve the equation $3x^2 - 4x = -2$ and express the roots in $a + bi$ form. [4]

b Triangle ABC has coordinates $A(-1,4)$, $B(3,7)$, and $C(5,1)$.

(1) On graph paper, draw and label $\triangle ABC$. [1]

(2) Graph and state the coordinates of $\triangle A'B'C'$, the image of $\triangle ABC$ under the composition $R_{0,90°} \circ r_{x\text{-axis}}$. [3]

(3) State the single transformation equivalent to $R_{0,90°} \circ r_{x\text{-axis}}$. [2]

☞ **GO RIGHT ON TO THE NEXT PAGE.**

41 *a* Express as a fraction in simplest form:

$$\frac{\frac{1}{n} - \frac{1}{3n^2}}{1 - \frac{1}{9n^2}}$$ [5]

b Show graphically that the sum of $3 + i$ and $5 - 3i$ is $8 - 2i$. [5]

42 *a* Sketch the graph of $y = 2^x$ over the set of real numbers. [4]

b Given the function: $y = 2^x$

(1) Express the value of y if $x = -4$. [2]

(2) Using logarithms, find the value of y to the *nearest tenth* if $x = \frac{3}{4}$. [4]