

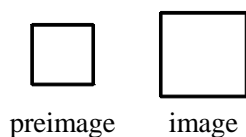
### Part I

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 letter preceding the word or expression that best completes the statement or answers the question. [40]

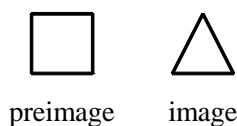
1. Evaluate.  $i^{58}$       [A] 1      [B]  $-1$       [C]  $-i$       [D]  $i$

2. Which of the following transformations represents an isometry?

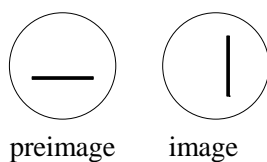
[A]



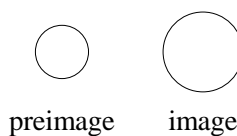
[B]



[C]



[D]



3. Find the third term in the expansion of  $(e - 3f)^6$ .

[A]  $-540e^4f^2$       [B]  $135e^4f^2$       [C]  $135e^2f^4$       [D]  $-540e^2f^4$

4. Given  $\log_{10} 2 = M$  and  $\log_{10} 11 = N$ , find  $\log_{10} 22$ .

[A]  $10^{M+N}$       [B]  $10^{MN}$       [C]  $M + N$       [D]  $MN$

5. Given  $\sin \theta = \frac{1}{5}$  and  $\sec \theta < 0$ , find  $\cos \theta$  and  $\tan \theta$ .

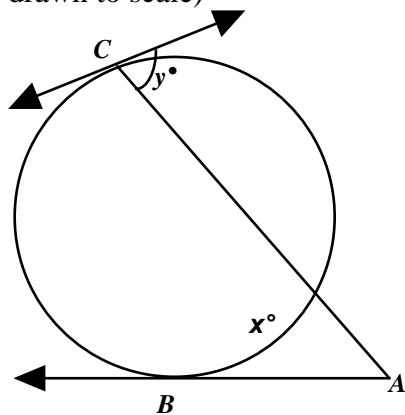
[A]  $\cos \theta = -\frac{2\sqrt{6}}{5}$ ,  $\tan \theta = \frac{1}{2\sqrt{6}}$       [B]  $\cos \theta = -2\sqrt{6}$ ,  $\tan \theta = -\frac{5}{2\sqrt{6}}$

[C]  $\cos \theta = -\frac{2\sqrt{6}}{5}$ ,  $\tan \theta = -\frac{1}{2\sqrt{6}}$       [D]  $\cos \theta = \frac{2\sqrt{6}}{5}$ ,  $\tan \theta = \frac{1}{2\sqrt{6}}$

6. A fair coin is tossed 12 times. What is the probability of obtaining exactly 10 heads?

[A] 0.0537      [B] 0.0029      [C] 0.0161      [D] 0.1208

7. Find the measure of each variable if  $m\angle A = 31$  and  $m\widehat{BC} = 103$ . (not drawn to scale)



[A] 41; 216      [B] 72; 216      [C] 41; 108      [D] 72; 108

8. Simplify.  $\frac{6}{7 - \sqrt{3}}$

[A]  $\frac{9}{13}$

[B]  $\frac{6\sqrt{3}}{7\sqrt{3} - 3}$

[C]  $\frac{42 + \sqrt{3}}{46}$

[D]  $\frac{21 + 3\sqrt{3}}{23}$

9. Use special right triangles to find the coordinates of the point of intersection of the angle  $45^\circ$  and the unit circle. Express your answer in fractions and radicals when necessary.

[A]  $\left(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)$

[B]  $(\sqrt{2}, \sqrt{2})$

[C]  $(-\sqrt{2}, -\sqrt{2})$

[D]  $\left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$

10. Solve the system of equations.

$$y = |x| - 5$$

$$y = -x^2 + 1$$

[A]  $(2, -3), (-2, -3)$

[B]  $(2, -3), (-1, -5)$

[C]  $(-4, -2), (-1, -5)$

[D]  $(-4, -2), (-2, -3)$

11. A certain gas will escape from a storage tank according to the formula  $e = 160\sqrt{p}$ , where  $e$  represents the amount escaping per minute in gallons, and  $p$  represents the pressure in pounds per square inch. What is the pressure on the gas when about 200 gallons per minute are escaping? Round your answer to the nearest tenth.

[A] 19.0 lb/in.<sup>2</sup>      [B] 1.3 lb/in.<sup>2</sup>      [C] 1.6 lb/in.<sup>2</sup>      [D] 0.8 lb/in.<sup>2</sup>

12. Divide:  $\frac{x+7}{x-7} \div \frac{x^2-49}{7-x}$

[A]  $\frac{1}{7-x}$       [B]  $\frac{1}{9-x}$       [C]  $\frac{1}{x-7}$       [D]  $\frac{x+7}{x-7}$

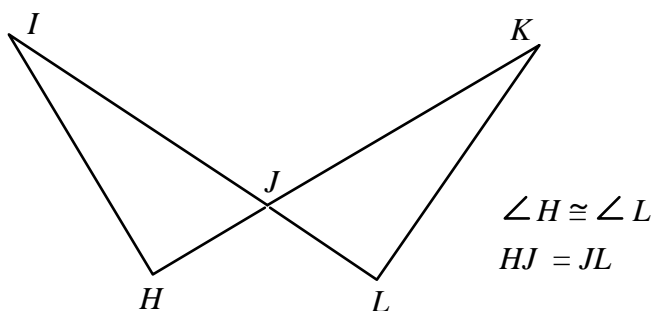
13. Solve:  $\log_8 (x+1) = -2$

[A] 255      [B]  $-\frac{63}{64}$       [C]  $\frac{1}{512}$       [D]  $\frac{65}{64}$

14. When Spheres-R-Us ships bags of golf balls, each bag must be within 9 balls of 720. Which equation is an absolute value equation representing the high and low values, and what are those values?

[A]  $|m-720|=9$ ; 711, 729      [B]  $|720-9|=m$ ; 9, 18  
[C]  $|m-9|=720$ ; 711, 729      [D]  $|720-m|=9$ ; 9, 18

15. Refer to the figure shown. Which of the following statements is true?



- [A]  $\triangle HIJ \cong \triangle LKJ$  by ASA.      [B]  $\triangle HIJ \cong \triangle KLJ$  by SAS.  
 [C]  $\triangle HIJ \cong \triangle KLJ$  by ASA.      [D]  $\triangle HIJ \cong \triangle JKL$  by SAS.
16. Sean and Jackie made a shady area by stretching a bedspread over a clothesline. The bedspread was 2.8 m long and made an angle of  $51^\circ$  with the ground where it was anchored at each side. How wide was the shady area?

- [A] 1.2 m      [B] 2.8 m      [C] 1.8 m      [D] 0.2 m

17. Solve. Find all solutions from 0 to  $2\pi$ .  $\tan^2 \theta = \frac{\sqrt{2}}{2} \sec \theta$

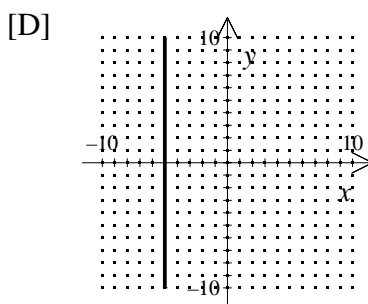
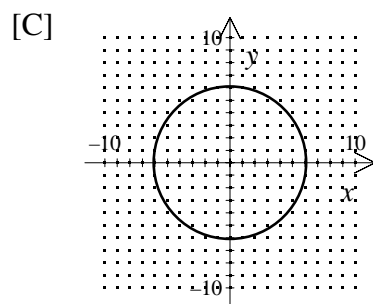
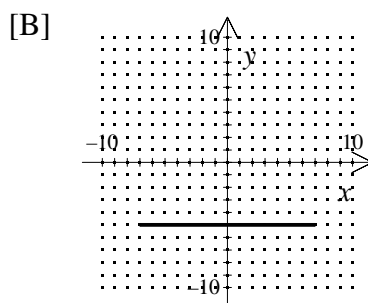
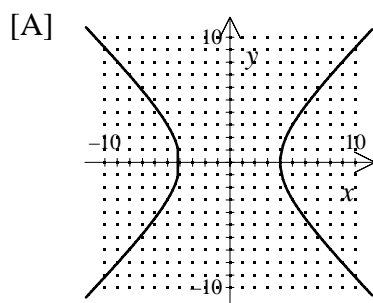
- [A]  $\frac{5\pi}{6}, \frac{7\pi}{6}$       [B]  $\frac{2\pi}{3}, \frac{4\pi}{3}$       [C]  $\frac{3\pi}{4}, \frac{5\pi}{4}$       [D] none of these

18. Solve the inequality and give the solution in set builder notation.

$$x^2 + 2x - 63 < 0$$

- [A]  $\{x \mid x < -9 \text{ or } x > 7\}$       [B]  $\{x \mid x < -7 \text{ or } x > 9\}$   
 [C]  $\{x \mid -9 < x < 7\}$       [D]  $\{x \mid -7 < x < 9\}$

19. Which graph represents a function?



20. Evaluate the following expression:  $\sum_{k=2}^8 (k^2 - 2k + 3)$

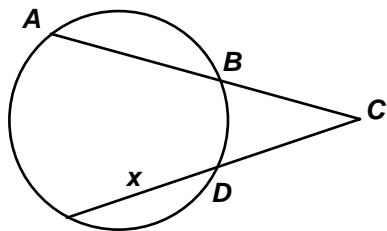
- [A] 158      [B] 156      [C] 103      [D] 154

## 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. The time  $t$  required to drive a certain distance varies inversely as the speed  $r$ . If it takes 2 hours to drive the distance at 50 miles per hour, how long will it take to drive the same distance at 60 miles per hour?

22. Find the value of  $x$  if  $AB = 21$ ,  $BC = 12$ , and  $CD = 14$ . (not drawn to scale)



23. Simplify:  $4i^7 + 3i^2 - 2i^3 - 4$

24. Solve:  $4^{7x+9} = 8$

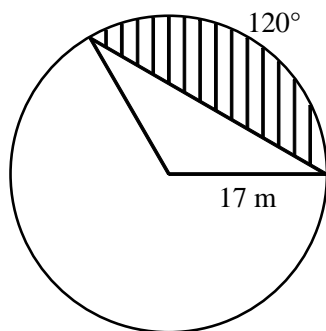
25. Last year, the personal best high jumps of track athletes in a nearby state were normally distributed with a mean of 225 cm and a standard deviation of 18 cm. What is the probability that a randomly selected high jumper has a personal best between 243 and 261 cm?

26. If  $f(x) = 3x + 3$  and  $g(x) = x + 5$ , find  $g(f(-1))$ .

### 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. Find the area of the shaded segment. Round your answer to the nearest hundredth.



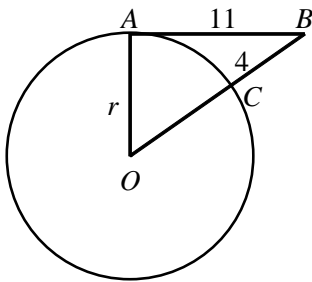
28. Solve:  $-3x + 6 + 7x^2 = 0$



29. Write an exponential function to model the situation. Then predict the value of the function after 5 years (to the nearest whole number).  
A population of 260 animals that decreases at an annual rate of 10%.

30. Change the equation to standard form and name the figure.  
 $2x^2 + 2y^2 + 24x - 4y + 62 = 0$

31.  $\overline{AB}$  is tangent to  $\odot O$  at  $A$  (not drawn to scale). Find the length of the radius  $r$ , to the nearest tenth.



32. The table shows the number of llamas born on llama ranches worldwide since 1988. Find a cubic function to model the data and use it to estimate the number of births in 1999.

Years since 1988	1	3	5	7	9
Llamas born (in thousands)	1.1	19.3	78.3	202.1	414.7

#### 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. Solve triangle  $ABC$  given that  $a = 20$ ,  $b = 12$ , and  $c = 10$ .

34. Draw a figure in the coordinate plane and write a two-column coordinate proof.

Given: Quadrilateral  $ABCD$  with  $A(-5, 0)$ ,  $B(-1, -7)$ ,  $C(6, -3)$ ,  $D(2, 4)$ .

Prove:  $ABCD$  is a rectangle.