

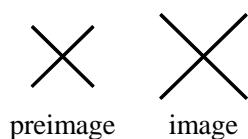
### Part I

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]

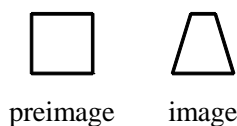
1. Evaluate.  $i^{12}$       [A]  $i$       [B]  $1$       [C]  $-i$       [D]  $-1$

2. Which of the following transformations represents an isometry?

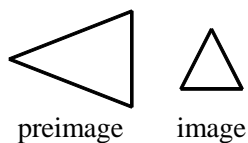
[A]



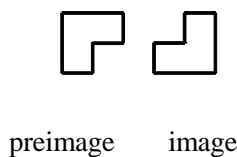
[B]



[C]



[D]



3. Find the sixth term in the expansion of  $(u - 2v)^8$ .

[A]  $-1792uv^7$       [B]  $28uv^7$       [C]  $28u^3v^5$       [D]  $-1792u^3v^5$

4. Given  $\log_{10} 2 = E$  and  $\log_{10} 5 = F$ , find  $\log_{10} 10$ .

[A]  $10^{E+F}$       [B]  $10^{EF}$       [C]  $EF$       [D]  $E + F$

5. Given  $\sin \theta = \frac{4}{7}$  and  $\sec \theta < 0$ , find  $\cos \theta$  and  $\tan \theta$ .

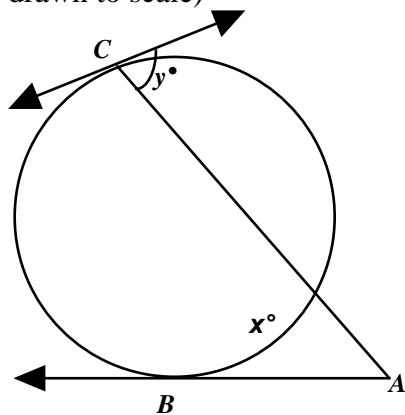
[A]  $\cos \theta = -\frac{\sqrt{33}}{7}$ ,  $\tan \theta = \frac{4}{\sqrt{33}}$       [B]  $\cos \theta = -\sqrt{33}$ ,  $\tan \theta = -\frac{7}{\sqrt{33}}$

[C]  $\cos \theta = \frac{\sqrt{33}}{7}$ ,  $\tan \theta = \frac{4}{\sqrt{33}}$       [D]  $\cos \theta = -\frac{\sqrt{33}}{7}$ ,  $\tan \theta = -\frac{4}{\sqrt{33}}$

6. A fair coin is tossed 14 times. What is the probability of obtaining exactly 1 head?

[A] 0.0009      [B] 0.0056      [C] 0.0222      [D] 0.0001

7. Find the measure of each variable if  $m\angle A = 37$  and  $m\widehat{BC} = 85$ . (not drawn to scale)



[A] 48; 132      [B] 11; 264      [C] 11; 132      [D] 48; 264

8. Simplify.  $\frac{8}{6 - \sqrt{2}}$

[A]  $\frac{8\sqrt{2}}{6\sqrt{2} - 2}$

[B]  $\frac{32}{19}$

[C]  $\frac{24 + 4\sqrt{2}}{17}$

[D]  $\frac{48 + \sqrt{2}}{34}$

9. Use special right triangles to find the coordinates of the point of intersection of the angle  $210^\circ$  and the unit circle. Express your answer in fractions and radicals when necessary.

[A]  $\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$

[B]  $\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$

[C]  $\left(-\frac{2\sqrt{3}}{3}, -2\right)$

[D]  $\left(\frac{2\sqrt{3}}{3}, 2\right)$

10. Solve the system of equations.

$$y = |x| + 1$$

$$y = -x^2 + 3$$

[A]  $(1, 2), (-1, 2)$

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

[C]  $(-3, 3), (0, 0)$

[D]  $(1, 2), (0, 0)$

11. A certain gas will escape from a storage tank according to the formula  $e = 190\sqrt{p}$ , 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 450 gallons per minute are escaping? Round your answer to the nearest tenth.

[A] 2.4 lb/in.<sup>2</sup>      [B] 5.6 lb/in.<sup>2</sup>      [C] 0.4 lb/in.<sup>2</sup>      [D] 25.3 lb/in.<sup>2</sup>

12. Divide:  $\frac{x+1}{x-1} \div \frac{x^2-1}{1-x}$

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

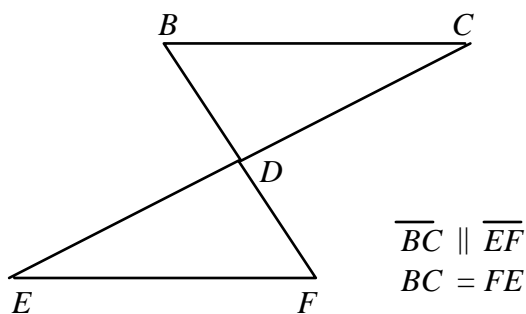
13. Solve:  $\log_2(x+7) = -3$

[A] 2      [B]  $-\frac{55}{8}$       [C]  $\frac{1}{1024}$       [D]  $\frac{57}{8}$

14. When Spheres-R-Us ships bags of golf balls, each bag must be within 8 balls of 340. Which equation is an absolute value equation representing the high and low values, and what are those values?

[A]  $|340-m|=8$ ; 8, 16      [B]  $|m-8|=340$ ; 332, 348  
[C]  $|340-8|=m$ ; 8, 16      [D]  $|m-340|=8$ ; 332, 348

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



- [A]  $\triangle BCD \cong \triangle EFD$  by ASA.      [B]  $\triangle BCD \cong \triangle FED$  by ASA.  
 [C]  $\triangle BCD \cong \triangle DFE$  by ASA.      [D]  $\triangle BCD \cong \triangle DFE$  by SAS.
16. Sean and Jackie made a shady area by stretching a bedspread over a clothesline. The bedspread was 2.9 m long and made an angle of  $44^\circ$  with the ground where it was anchored at each side. How wide was the shady area?
- [A] 0.2 m      [B] 3.1 m      [C] 2.1 m      [D] 1.2 m

17. Solve. Find all solutions from 0 to  $2\pi$ .  $\tan^2 \theta = -\frac{\sqrt{2}}{2} \sec \theta$
- [A]  $\frac{\pi}{4}, \frac{7\pi}{4}$       [B]  $\frac{\pi}{6}, \frac{11\pi}{6}$       [C]  $\frac{3\pi}{4}, \frac{5\pi}{4}$       [D] none of these

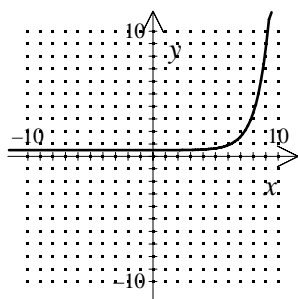
18. Solve the inequality and give the solution in set builder notation.

$$x^2 - 4x - 5 > 0$$

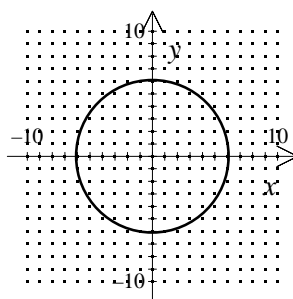
- [A]  $\{x \mid x < -5 \text{ or } x > 1\}$       [B]  $\{x \mid -5 < x < 1\}$   
 [C]  $\{x \mid -1 < x < 5\}$       [D]  $\{x \mid x < -1 \text{ or } x > 5\}$

19. Which graph represents a function?

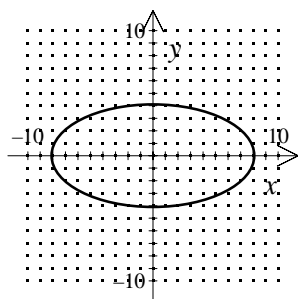
[A]



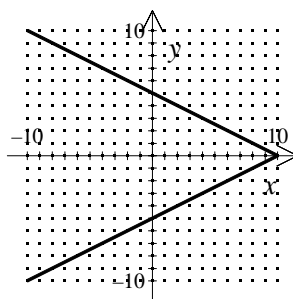
[B]



[C]



[D]



20. Evaluate the following expression to three decimal places:  $\sum_{k=3}^9 \left(\frac{1}{2}\right)^k$

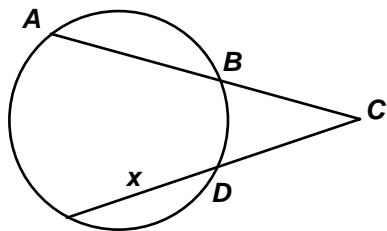
- [A] 0.248      [B] 0.998      [C] 0.246      [D] 0.124

## 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 8 hours to drive the distance at 25 miles per hour, how long will it take to drive the same distance at 45 miles per hour?

22. Find the value of  $x$  if  $AB = 18$ ,  $BC = 9$ , and  $CD = 10$ . (not drawn to scale)



23. Simplify:  $2i^5 - 5i^3 + 4i^6 - 2$

24. Solve:  $64^{6x-4} = 16$

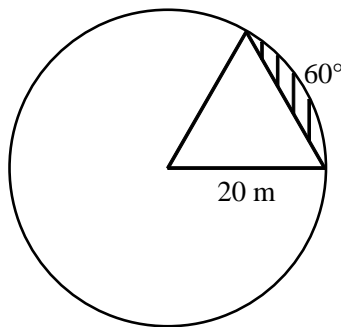
25. Last year, the personal best high jumps of track athletes in a nearby state were normally distributed with a mean of 201 cm and a standard deviation of 10 cm. What is the probability that a randomly selected high jumper has a personal best between 201 and 211 cm?

26. If  $f(x) = 4x + 2$  and  $g(x) = x - 2$ , find  $f(g(-4))$ .

### 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:  $-5x + 7 + 9x^2 = 0$

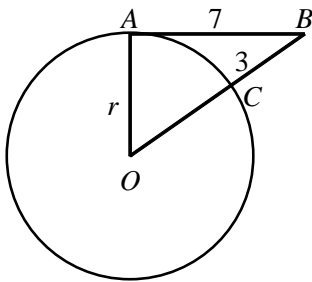


29. Write an exponential function to model the situation. Then predict the value of the function after 5 years (to the nearest whole number).  
A population of 280 animals that increases at an annual rate of 14%.

30. Change the equation to standard form and name the figure.

$$4x^2 + 4y^2 + 56x - 56y + 384 = 0$$

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)	1.2	8.4	26.8	61.2	116.4

#### 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  $a = 21$ ,  $b = 18$ , and  $c = 19$ .
34. Draw a figure in the coordinate plane and write a two-column coordinate proof.  
Given: Quadrilateral  $ABCD$  with  $A(-5, 0)$ ,  $B(2, -4)$ ,  $C(6, 3)$ ,  $D(-1, 7)$ .  
Prove:  $ABCD$  is a rectangle.