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 expresson that best completes the statement or answers the question. [40]

1. Evaluate. i^{77} [A] i [B] -1 [C] $-i$ [D] 1

2. Which of the following transformations represents an isometry?

[A]

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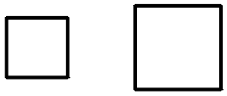
[B]



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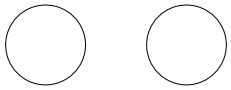
[C]



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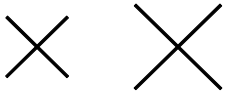
[D]



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3. Find the fourth term in the expansion of $(y+2z)^7$.

[A] $700y^2z^5$ [B] $280y^2z^5$ [C] $280y^4z^3$ [D] $700y^4z^3$

4. Given $\log_{10}7 = G$ and $\log_{10}11 = H$, find $\log_{10}77$.

[A] 10^{GH} [B] 10^{G+H} [C] GH [D] $G + H$

5. Given $\sin\theta = \frac{4}{9}$ and $\sec\theta < 0$, find $\cos\theta$ and $\tan\theta$.

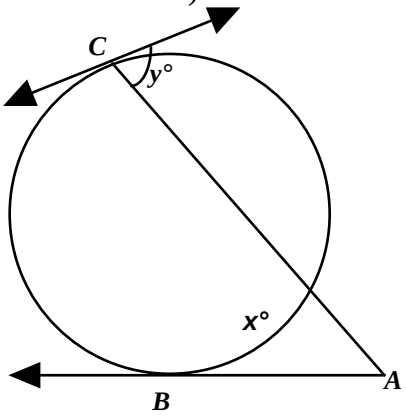
[A] $\cos\theta = -\frac{\sqrt{65}}{9}$, $\tan\theta = \frac{4}{\sqrt{65}}$ [B] $\cos\theta = -\frac{\sqrt{65}}{9}$, $\tan\theta = -\frac{4}{\sqrt{65}}$

[C] $\cos\theta = -\sqrt{65}$, $\tan\theta = -\frac{9}{\sqrt{65}}$ [D] $\cos\theta = \frac{\sqrt{65}}{9}$, $\tan\theta = \frac{4}{\sqrt{65}}$

6. A fair coin is tossed 16 times. What is the probability of obtaining exactly 1 head?

[A] 0.0000 [B] 0.0018 [C] 0.0085 [D] 0.0002

7. Find the measure of each variable if $m\angle A = 28$ and $m\overset{\frown}{BC} = 91$. (not drawn to scale)



[A] 63; 117 [B] 35; 117 [C] 35; 234 [D] 63; 234

8. Simplify. $\dfrac{2}{9 - \sqrt{6}}$

[A] $\dfrac{18 + \sqrt{6}}{75}$ [B] $\dfrac{4}{87}$ [C] $\dfrac{2\sqrt{6}}{9\sqrt{6} - 6}$ [D] $\dfrac{18 + 2\sqrt{6}}{75}$

9. Use special right triangles to find the coordinates of the point of intersection of the angle $150°$ and the unit circle. Express your answer in fractions and radicals when necessary.

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

[C] $\left(-\dfrac{2\sqrt{3}}{3}, 2\right)$ [D] $\left(-\dfrac{\sqrt{3}}{2}, \dfrac{1}{2}\right)$

10. Solve the system of equations.

$y = |x| - 6$

$y = -x^2 - 4$

[A] (–3, –4), (–1, –5) [B] (1, –5), (–1, –5)

[C] (–3, –4), (0, –7) [D] (1, –5), (0, –7)

11. A certain gas will escape from a storage tank according to the formula $e = 140\sqrt{p}$, 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 225 gallons per minute are escaping? Round your answer to the nearest tenth.

[A] 1.6 lb/in.^{2} [B] 2.6 lb/in.^{2} [C] 19.1 lb/in.^{2} [D] 0.6 lb/in.^{2}

12. Divide: $\frac{x+5}{x-5} \div \frac{x^2-25}{5-x}$

[A] $\frac{1}{3-x}$ [B] $\frac{1}{5-x}$ [C] $\frac{x+5}{x-5}$ [D] $\frac{1}{x-5}$

13. Solve: $\log_8 (x-3) = -2$

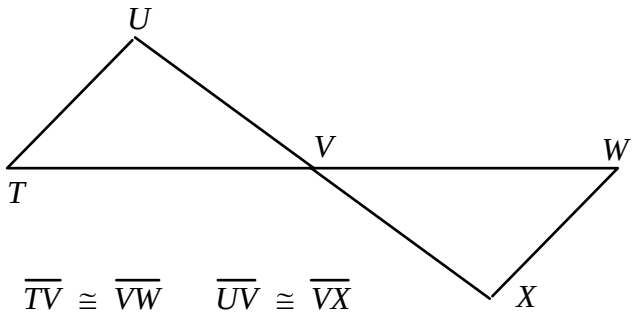
[A] $-\frac{191}{64}$ [B] 8 [C] $\frac{193}{64}$ [D] 259

14. When Spheres-R-Us ships bags of golf balls, each bag must be within 5 balls of 410. Which equation is an absolute value equation representing the high and low values, and what are those values?

[A] $|410-m| = 5;\ 5,\ 10$ [B] $|m-5| = 410;\ 405,\ 415$

[C] $|m-410| = 5;\ 405,\ 415$ [D] $|410-5| = m;\ 5,\ 10$

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



$\overline{TV} \cong \overline{VW}$ $\overline{UV} \cong \overline{VX}$

[A] $\Delta TUV \cong \Delta VWX$ by SAS. [B] $\Delta TUV \cong \Delta WXV$ by SAS.

[C] $\Delta TUV \cong \Delta XWV$ by ASA. [D] $\Delta TUV \cong \Delta WXV$ by ASA.

16. Sean and Jackie made a shady area by stretching a bedspread over a clothesline. The bedspread was 3.9 m long and made an angle of $43°$ with the ground where it was anchored at each side. How wide was the shady area?

[A] 1.2 m [B] 0.2 m [C] 3.9 m [D] 2.9 m

17. Solve. Find all solutions from 0 to 2π. $\tan^2 \theta = -\frac{\sqrt{3}}{6} \sec \theta$

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

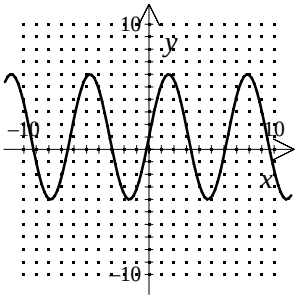
18. Solve the inequality and give the solution in set builder notation.
$x^2 + x - 56 > 0$

[A] $\{x \mid x < -7 \text{ or } x > 8\}$ [B] $\{x \mid x < -8 \text{ or } x > 7\}$

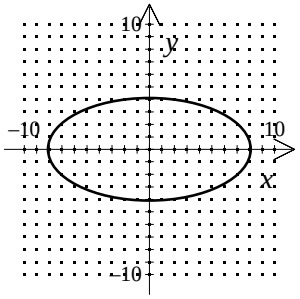
[C] $\{x \mid -7 < x < 8\}$ [D] $\{x \mid -8 < x < 7\}$

19. Which graph represents a function?

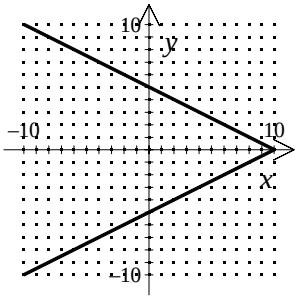
[A]



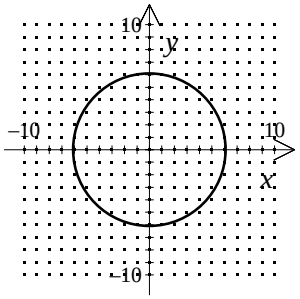
[B]



[C]



[D]



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

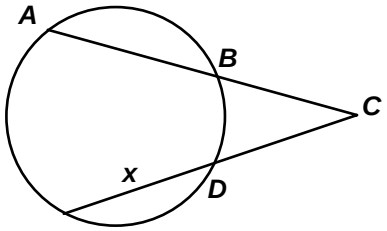
[A] 96 [B] 46 [C] 84 [D] 75

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 4 hours to drive the distance at 45 miles per hour, how long will it take to drive the same distance at 30 miles per hour?

22. Find the value of *x* if $AB = 24$, $BC = 13$, and $CD = 14$. (not drawn to scale)



23. Simplify: $3i^6 + 2i^4 + 3i^7 - 5$

24. Solve: $8^{4x+2} = 4$

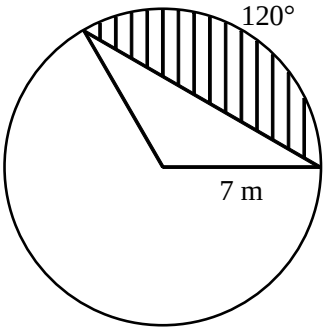
25. Last year, the personal best high jumps of track athletes in a nearby state were normally distributed with a mean of 226 cm and a standard deviation of 11 cm. What is the probability that a randomly selected high jumper has a personal best between 215 and 226 cm?

26. If $f(x) = 2x - 1$ and $g(x) = x + 3$, find $g(f(2))$.

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.

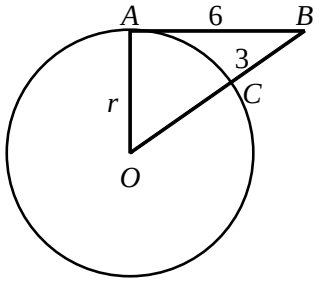


28. Solve: $-13x + 9 + 7x^2 = 0$

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 310 animals that increases at an annual rate of 16%.

30. Change the equation to standard form and name the figure.
$3x^2 - 2y^2 - 6x - 8y - 11 = 0$

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)	1.3	15.9	58.5	143.5	285.3

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 $a = 13$, $b = 17$, and $c = 15$.

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