1. Joe and Arlene ate lunch at The Cotton Patch. Both ordered the Salmon Dinner which costs $15.95 each and both ordered peach iced tea which costs $2.25 each. They shared a slice of chocolate cake which costs $4.95. The tax rate was 8.25%. Joe was feeling generous so he paid with three $20 bills and told the waitress to keep the change as a tip. How much was the tip?

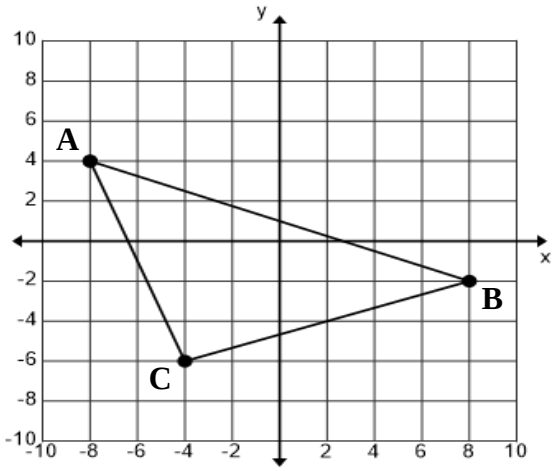
(A) $15.12 **(B) $15.15** **(C) $15.18** **(D) $15.21** **(E) $15.24**

2. The y-intercept of $\overleftrightarrow{AB}$ is the point $P(a, b)$.
$b =$ _____.

(A) $\frac{3}{4}$ **(B)** $\frac{7}{8}$ **(C) 1**
(D) $\frac{9}{8}$ **(E)** $\frac{5}{4}$

3. Point $D(3, d)$ lies on the perpendicular bisector of $\overline{CB}$. $d =$ _____.

(A) –10 **(B) –9** **(C) –8**
(D) –7 **(E) –6**



Problems 2-7

4. The perimeter of ΔABC is _____. (nearest tenth)

(A) 40.5 **(B) 40.8** **(C) 41.1**
(D) 41.4 **(E) 41.7**

5. The area of ΔABC is _____. (nearest tenth)
(nearest tenth)

(A) 67.1 **(B) 67.4** **(C) 67.7** **(D) 68.0** **(E) 68.3**

6. The length of the median from point C to $\overline{AB}$ is _____. (nearest hundredth)

(A) 8.03 **(B) 8.06** **(C) 8.09** **(D) 8.12** **(E) 8.15**

7. ΔABC is a/an _____triangle.__

(A) acute **(B) obtuse** **(C) right** **(D) isosceles** **(E) equilateral**

8. An adult ticket to an Idaho Falls game cost $10.00 and a youth ticket cost $6.00. On Tuesday night's game, they sold 396 tickets and grossed $3224. How many adult tickets did they sell?

(A) 208 **(B) 210** **(C) 212** **(D) 214** **(E) 216**

9. Given: $f(x) = 2x^2 - 6$ and $h(x) = e^x - 8$. $f(h(3)) =$ _____. (nearest hundredth)

(A) 283.09 **(B) 284.10** **(C) 285.11** **(D) 286.12** **(E) 287.13**

10. Find the range of the function $f(x)=\frac{5}{\sqrt{x^2-1}}$.

(A) $[0,\infty)$ (B) $(0,\infty)$ (C) $[5,\infty)$ (D) $(5,\infty)$ (E) $(-\infty,\infty)$

11. Justin can wash and wax 10 cars in 4 hours. Aryan can wash and wax 20 cars in 6 hours. Justin started work at 8:00 AM. Aryan arrived at 10:00 AM and they both worked from 10:00 AM until a total of 30 cars had been washed and waxed. What time was it when they finished if they took no breaks? (nearest minute)

(A) 2:17 PM (B) 2:20 PM (C) 2:23 PM (D) 2:26 PM (E) 2:29 PM

12. The roots of the quadratic equation $4x^2+bx+c=0$ are -2.5 and 1.5. $b+c=$ _____.

(A) -12 (B) -11 (C) -10 (D) -9 (E) -8

13. The 5th term of an arithmetic sequence is 23 and the 13th term is 55. Find the sum of the first 15 terms of the sequence. (nearest tenth)

(A) 513 (B) 517 (C) 521 (D) 525 (E) 529

14-15. Consider regular polygon ABCDEF with $EF=8$.

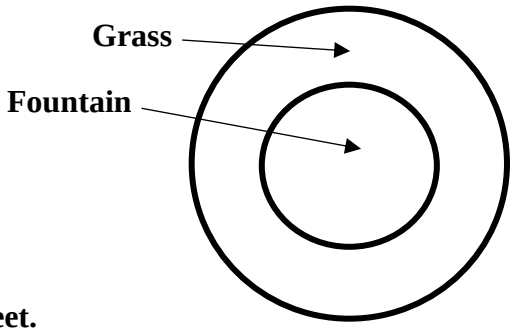
14. The area of the polygon is _____. (nearest whole number)

(A) 164 (B) 166 (C) 168 (D) 170 (E) 172

15. The area of ΔACE is _____. (nearest whole number)

(A) 75 (B) 77 (C) 79 (D) 81 (E) 83

16-17. Russell entertains guest in an area of his backyard which has a magnificent fountain surrounded by an area of grass. The fountain area is circular with a radius of 6 feet. The grass area is the outer part of a circle with the same center as the fountain and with a radius of 10 feet.



Problems 16, 17

16. The area of the grass region is _____ square feet. (nearest whole number)

(A) 201 (B) 205 (C) 209 (D) 213 (E) 217

17. Russell decided to put up a fence along the outer perimeter of the grass region. If the fence is 6 feet tall and the cost of fencing is $25/square foot, find the total cost of the fencing.

(A) $9,202.78 (B) $9,313.78 (C) $9,424.78 (D) $9,535.78 (E) $9,646.78

18-19. Consider a circle with center O and diameter $\overline{BD}$. Chord $\overline{AC}$ is perpendicular to $\overline{BD}$. $BD = 50$ and $AC = 40$.

18. Find the area of sector AOD. (nearest whole number)

(A) 686 (B) 689 (C) 692 (D) 695 (E) 698

19. Find the area of the region between chord $\overline{AC}$ and minor arc AC. (nearest whole number)

(A) 268 (B) 271 (C) 274 (D) 277 (E) 280

20-21. Consider isosceles trapezoid PQRS with $PQ = RS = 10$. $\overline{QR}$ is parallel to $\overline{PS}$. $QR = 15$ and $PS = 25$.

20. Find the area of PQRS. (nearest whole number)

(A) 173 (B) 176 (C) 179 (D) 182 (E) 185

21. QS = _____. (nearest tenth)

(A) 21.5 (B) 21.8 (C) 22.1 (D) 22.4 (E) 22.7

22. Suppose Calvin has 112 mg of bismuth-214 at 12:15 PM. His sample undergoes radioactive decay and is reduced to 74.562 µg at 3:45 PM the same day. Find the half-life of bismuth-214. (nearest tenth)

(A) 19.5 min (B) 19.7 min (C) 19.9 min (D) 20.1 min (E) 20.3 min

23. Eric is solving the equation $3x^2 + 3x - 90 = 0$ by completing the square. On the third step, Eric adds _____ to both sides of the equation.

(A) $\frac{1}{6}$ (B) $\frac{1}{5}$ (C) $\frac{1}{4}$ (D) $\frac{1}{3}$ (E) $\frac{1}{2}$

24-25. Consider the parabola with equation $9y = 2x^2 - 8x - 46$.

24. The vertex of the graph of the parabola is the point $P(a, b)$. $a + b =$ _____.

(A) –6 (B) –5 (C) –4 (D) –3 (E) –2

25. The equation of the directrix of the graph of the parabola is $y =$ _____.

(A) $-\frac{29}{4}$ (B) $-\frac{57}{8}$ (C) -7 (D) $-\frac{55}{8}$ (E) $-\frac{27}{4}$

26. The lateral area of a cone with a volume of 667 and a diameter of 14 is _____. (nearest hundredth)

(A) 320.59 (B) 321.61 (C) 322.63 (D) 323.65 (E) 324.67

27. Consider the function $f(x) = 4x^4 - 27x^3 + cx^2 + 7x + 30$. If $f(1) = 14$, then c = _____.

(A) –3 (B) –2 (C) 0 (D) 2 (E) 3

28. Consider the ellipse with equation $16x^2 + 9y^2 + 64x - 54y + 1 = 0$. The vertices of the graph of the ellipse are (a, b) and (a, c). $a + b + c =$ _____.

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

29. Consider the hyperbola with equation $9x^2 - 4y^2 - 108x - 16y + 272 = 0$. The eccentricity of the hyperbola is _____. (nearest tenth)

(A) 1.6 (B) 1.8 (C) 2.0 (D) 2.2 (E) 2.4

30. A stick in the ground is 4 ft 8 in tall and it casts a shadow that is 6 ft 2 in long. At the same time, the Newcastle State Bank casts a shadow that is 90 ft long. How tall is the bank? (nearest foot)

(A) 68 ft (B) 70 ft (C) 72 ft (D) 74 ft (E) 76 ft

31. Andrew has 12 marbles that are identical in size, but vary in color. Three are red, four are blue and five are green. If he wishes to place them in a straight line on a table, how many distinct arrangements can be made?

(A) 27,720 (B) 106,200 (C) 39,916,800 (D) 59,875,200 (E) 479,001,600

32. The graph of $f(x) = \dfrac{x^2 - 36}{x^3 - x^2 - 30x}$ has _____ asymptotes.

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

33. The sound level of a sound is given by $\beta = 10 \log\left(\dfrac{I}{I_0}\right)$, where β is the sound level in dB, I is the intensity in W/m^2, and I_0 is the threshold of hearing which equals 10^{-12} W/m^2. Find the difference in sound levels for a sound with an intensity of 7.75×10^{-3} W/m^2 and a sound with an intensity of 3.10×10^{-5} W/m^2. (nearest whole number)

(A) 24 dB (B) 28 dB (C) 32 dB (D) 36 dB (E) 40 dB

34. A guy wire runs from the ground to the top of a 42-foot pole. The angle formed between the wire and the pole is 44°. How far from the base of the pole is the wire attached to the ground? (nearest tenth)

(A) 40.0 ft (B) 40.2 ft (C) 40.4 ft (D) 40.6 ft (E) 40.8 ft

35. The first three terms of an infinite geometric series are 84, 72, and $61\frac{5}{7}$. Find the sum of the series.

(A) 540 (B) 552 (C) 564 (D) 576 (E) 588

36. The point $A(6, b)$ lies on the graph of the parametric equations $x(t) = \sqrt{2t}$ and $y(t) = \dfrac{10}{t+2}$, $0 \le t \le 60$. b = _____.

(A) $\frac{1}{5}$ **(B)** $\frac{1}{4}$ **(C)** $\frac{1}{2}$ **(D)** $\frac{3}{4}$ **(E)** $\frac{4}{5}$

37. The "on base percentage" for Maury Wills of the Portland Beavers is 0.355. If he has 10 at bats in a doubleheader against the Billings Broncos, what is the probability that he will safely get on base exactly 4 times. (nearest hundredth)

(A) 0.22 (B) 0.22 (C) 0.24 (D) 0.26 (E) 0.28

38. Given: $\vec{v} = \langle 1, 2, 3 \rangle$ and $\vec{w} = \langle 4, 5, 6 \rangle$. The unit vector in the direction of $2\vec{v} + 3\vec{w}$ is the vector $\left\langle \frac{a}{d}, \frac{b}{d}, \frac{c}{d} \right\rangle$ where d = _____. (nearest hundredth)

(A) 29.22 (B) 30.33 (C) 31.44 (D) 32.55 (E) 33.66

39. Consider the circle $x^2 + y^2 + 14x - 6y + 9 = 0$. The area of this circle is _____. (nearest tenth)

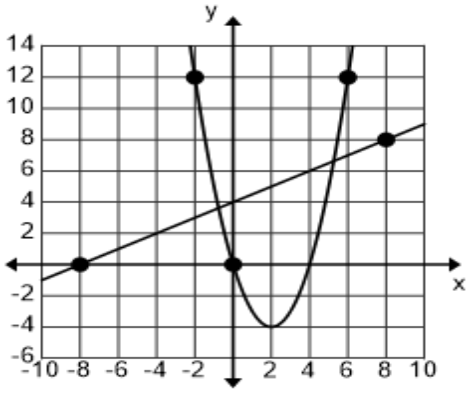
(A) 151.8 (B) 153.9 (C) 156.0 (D) 158.1 (E) 160.2

40. The points of intersection of the curves shown on the right are P and Q. PQ = _____. (nearest tenth)

(A) 6.3 (B) 6.5 (C) 6.7
(D) 6.9 (E) 7.1

41. Find the area bounded by the two curves shown on the right. (nearest tenth)

(A) 36.4 (B) 36.6 (C) 36.8
(D) 37.0 (E) 37.2



Problems 40, 41

42. The _____ Theorem states that "If f is a continuous, real valued function defined on an an interval $[a, b]$, with $f(a) \ne f(b)$, and k is a real number between $f(a)$ and $f(b)$, then there exists some $c \in (a, b)$ such that $f(c) = k$."

(A) Sandwich (B) Mean Value (C) Extreme Value (D) Intermediate Value (E) Bounded

43. Emmitt won the lottery and decided to purchase some land near Lubbock and raise emus. He wanted to build a pen in the shape of a rectangle to keep his emus. He has 480 feet of fencing to use for three sides of the pen. He will use one side of his large barn as the fourth side. What is the maximum area of the pen? (nearest square foot)

(A) 24,400 ft^2 (B) 25,500 ft^2 (C) 26,600 ft^2 (D) 27,700 ft^2 (E) 28,800 ft^2

44. An 18-ft-long ladder rests against the wall of a building. The foot of the ladder begins to slide away from the building at a constant rate of 6 in/s. How fast is the top of the ladder sliding down the wall at the instant the ladder makes an angle of 30° with the wall? (nearest hundredth)

(A) 3.02 in/s **(B) 3.13 in/s** **(C) 3.24 in/s** **(D) 3.35 in/s** **(E) 3.46 in/s**

45. Find the area of the region in the first quadrant bounded by the graphs of $y_1 = 3 + \cos(x)$ and $y_2 = 2 - \cos(x)$ and the y-axis. (nearest tenth)

(A) 3.8 **(B) 4.0** **(C) 4.2** **(D) 4.4** **(E) 4.6**

46. Find the slope of the line tangent to the curve $2y^2 - 6xy + 3x^3 - 4y = 8$ when $x = 1$ and $y > 0$. (nearest hundredth)

(A) 2.01 **(B) 2.04** **(C) 2.07** **(D) 2.10** **(E) 2.13**

47. To evaluate $\int \sin^5(x)\cos(x)dx$ using a u-substitution, the best choice for u is _____.

(A) $\sin(x)dx$ **(B) $\cos(x)dx$** **(C) $\sin^5(x)$** **(D) $\sin(x)$** **(E) $\cos(x)$**

48. To evaluate $\int x^2 \sin(x)dx$ using integration by parts, the best choice for u is _____.

(A) $2xdx$ **(B) x^2** **(C) $\sin(x)$** **(D) $\cos(x)dx$** **(E) $\sin(x)dx$**

49. Experts from Texas Tech believe that Newberry State Park in Seminole is capable of supporting no more than 250 prairie dogs. On April 1, 2012, Anthony introduced the first pair of prairie dogs. On April 1, 2020 the population had reached 60 prairie dogs. Professor Cravens commissioned Carter to develop a logistic model of the prairie dog population. The logistic model predicts that there should be about _____ prairie dogs in 2030.

(A) 210 **(B) 218** **(C) 226** **(D) 234** **(E) 242**

50-51. (rad) Consider the curve given by $x(t) = \sin(t)$ and $y(t) = t + \cos(t)$, $\frac{\pi}{2} \le t \le \frac{5\pi}{2}$.

50. Find the length of the curve. (nearest hundredth)

(A) 7.52 **(B) 7.64** **(C) 7.76** **(D) 7.88** **(E) 8.00**

51. The tangent line when $t = \pi$ intersects the tangent line when $t = 2\pi$ at the point $P(a, b)$. $a + b =$ _____. (nearest hundredth)

(A) 2.14 **(B) 2.17** **(C) 2.20** **(D) 2.23** **(E) 2.26**

1	2	3	4	5	6	7	8
212	224	239	166	202	272	218	188

Brent loves to bowl. The table above shows the scores from the eight games he bowled on Friday night at Salado Lanes. Use this table for problems 52 and 53.

52. Find the positive difference between Brent's mean score and median score.

(A) 0 **(B) 0.125** **(C) 0.25** **(D) 0.375** **(E) 0.5**

53. How many of his scores are classified as outliers?

(A) 0 **(B) 1** **(C) 2** **(D) 3** **(E) 4**

Week	1	2	3	4	5	6
Miles	22	27	31	37	40	46

Use the table above for problems 54 and 55.

54. Carmen began her 10-week buildup for cross country in June. She ran at 7-minute pace over hilly terrain and gradually increased her mileage each week. The table above shows her mileage total for each of the first six weeks of her buildup. When she plotted her data, she believed a linear model fit her data pretty well. Use a linear model to predict her mileage for week 10. (nearest tenth)

(A) 64.5 mi **(B) 64.8 mi** **(C) 65.1 mi** **(D) 65.4 mi** **(E) 65.7 mi**

55. If she actually ran 58 miles in week 8, what is the residual for week 8? (nearest hundredth)

(A) 2.51 mi **(B) 2.62 mi** **(C) 2.73 mi** **(D) 2.84 mi** **(E) 2.95 mi**

56. Four hundred seniors are enrolled in the Patton Springs Stem Academy. Two hundred sixteen are taking Calculus, one hundred eighty-four are taking Statistics, and one hundred forty-eight are taking Physics. Thirty-six are taking Statistics and Calculus, but not Physics. Sixty-four are taking Calculus and Physics, but not Statistics. Twenty-two are taking Statistics and Physics, but not Calculus. Sixty-two are not taking any of these three classes. How many seniors are taking all three of these classes?

(A) 40 **(B) 42** **(C) 44** **(D) 46** **(E) 48**

57. There are so many students applying to attend the Patton Springs Stem Academy that a math readiness test is given to all applicants and the scores on these tests are used as part of the admission process. The mean score on math readiness test is 856 with a standard deviation of 48. If Kyle scored 915 on the math readiness test, what percentile does that place him at? (nearest tenth)

(A) 89^{th} **(B) 91^{st}** **(C) 93^{rd}** **(D) 95^{th}** **(E) 97^{th}**

58. Assume that the mean distance for the men's shot in Diamond League competition is 65 ft 2 in with a standard deviation of 4 ft 1 in. For women, assume the mean distance is 58 ft 3 in with a standard deviation of 3 ft 11 in. If Ryan's best is 77 ft 3.75 in and Valerie's best is 69 ft 8 in, who had a better performance based on z-scores? Ryan's performance was slightly better because his z-score minus Valerie's z-score = _____. (nearest thousandth)

(A) 0.060 (B) 0.072 (C) 0.084 (D) 0.096 (E) 0.108

59-60. A large Supermarket chain requires that no more than 10% of apples they receive have defects. When a recent shipment came in, inspectors took a random sample of 400 apples and they determined that 50 of the apples had defects. The data was given to a highly paid analyst. She performed an appropriate test at the $\alpha = 0.05$ level and made a recommendation.

59. The appropriate test was the _____ Test.

(A) T-test
(B) One Sample z Test for a Proportion
(C) Chi-Square Goodness of Fit Test
(D) Linear Regression T Test
(E) Chi-Square Test of Independence

60. Based on a P-value of _____ (nearest thousandth), she recommended the shipment be rejected.

(A) 0.036 (B) 0.040 (C) 0.044 (D) 0.048 (E) 0.052