

A Collection of UIL Math Problems

anastasia :3

2024

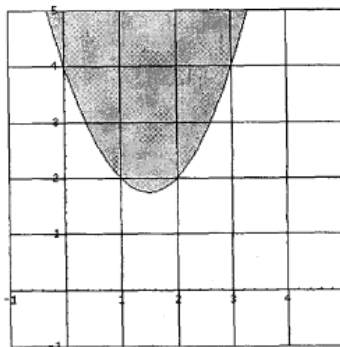
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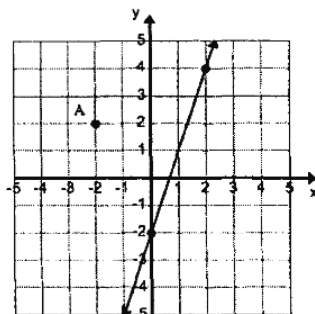
1 Algebra

Problems

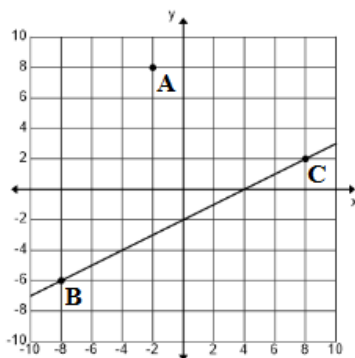
1. Evaluate: $1 \times (2 + 3)^{-1} - 4 \div \frac{5}{6} + 7 \times (8)^0$
2. If x is 40% less than y and y is 30% more than z , then x is _____ than z .
3. Mora Doe goes to the 25% off book sale. She buys 4 romantic novels which cost \$11.95 each before the sale and includes tax. She gave the clerk 2 twenty-dollar bills. How much change should Mora receive?
4. If $9x^2 - 12x + 4 = (ax - b)^2$ then $a + b = \dots\dots\dots$
5. Harry Hare drove 210 km to Myrtle Turtle's house. Part of the 4 hour trip was in town at 30 km/h and the rest was on a major highway at 60 km/h. How many km did Harry drive on the major highway?
6. Simplify: $\log_b(3xy) - \log_b(\frac{3x}{2y}) + \log_b(3y^2)$
7. Line m goes through points $(1, -1)$ and $(-3, 1)$. Line n goes through points $(1, 1)$ and (x, y) . Which of the following points lies on line n if $m \perp n$?
8. Which of the equations will produce the shaded portion of the graph shown?



9. The first five terms of an infinite arithmetic sequence is $6\frac{1}{4}, A, B, C, 12\frac{1}{2}, \dots$. Find $A + B + C$.
10. The numbers of integers that satisfy the inequality new $\frac{3}{7} < \frac{n}{14} < \frac{2}{3}$ is:
11. Define $n\star$ to be n^n . Compute $(2\star)\star$.
12. Evaluate: $\frac{3}{8} \div .75 \times \frac{1}{2} - .25 + \frac{1}{16}$
13. A legend on a map shows 2.5 cm representing 200 miles. The distance on the map from El Paso to Texarkana is 9.8 cm. According to the map, how far is it from El Paso to Texarkana?
14. Phil Errup's car has a gas tank with a capacity of 18 gallons. The gauge shows that it is $\frac{1}{4}$ full. How many gallons will need to be added to the tank so that it is 75% full?
15. Find the equation of the line shown.



16. Let p and q be the roots of $8x^2 + 2x - 15 = 0$. Find $p^3 + 3p^2q + 3pq^2 + q^3$.
17. One of the factors of $x^3 - 3x^2 - 3x + 18$ is:
 (A) $x + 2$ (B) $x + 3$ (C) $x + 6$ (D) $x - 2$ (E) $x - 9$
18. The roots of the equation $x^3 - 5x^2 + cx + 24 = 0$ are 3, 4, and R . Find c .
19. Let $f(x) = 2x + 5$ and $g(x) = 3x - 4$ and $h(x) = 6x$. Find $f(g(h(-1)))$.
20. The coefficient of the 2nd term of the expansion of $(3x - 4)^5$ is:
21. Solve for k if $3k - 4 = 28 - 5k$
22. Joe's dad sent him to the Burger Barn with three twenty-dollar bills and one five-dollar bill. He ordered 6 cheeseburgers for \$4.85 each, one basket of fries for \$5.75, 6 large cokes for \$2.19 each and 6 lemon pies for \$1.25 each. The tax rate is 8.25%. How much change did he receive?
23. Consider a line that is perpendicular to \overline{BC} and also contains point A . If the x -intercept of this line is $(a, 0)$, then $a = \text{-----}$.



24. The Reagan High math/science team brought in the Quebe Sisters for a UIL fundraiser. Their fee to appear was \$5,000. Their version of "San Antonio Rose" is outstanding. A student ticket cost \$8.00 and an adult ticket cost \$15.00. A total of 2100 tickets were sold and \$20,375 was raised after paying the fee. How many adult tickets were sold?
25. Consider four consecutive even integers, all positive, such that five times the sum of the first two exceeds three times the sum of the first and fourth by 80. The third integer is -----.
26. Simplify: $\frac{\frac{c}{w} + \frac{d}{w^2}}{\frac{m}{w^2} + \frac{k}{hw}}$
27. If $f(x) = x^2 + 4$ and $h(x) = 3x - 1$, then $f(h(5)) = \text{-----}$.
28. Find the number that is $\frac{5}{6}$ of the way from $-4\frac{1}{2}$ to $9\frac{3}{8}$.
29. Cindy rode her bike for 60 miles at 24 mph and then rode 36 miles at 30 mph. How fast does she need to ride the final 44 miles to have an overall speed of 28 mph? (nearest tenth)

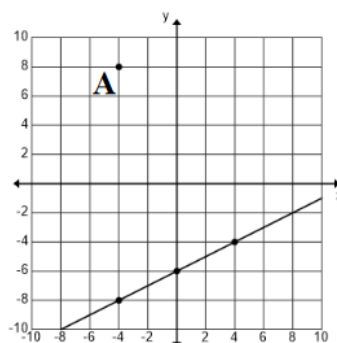
30. Consider the points $A(-6, 10)$ and $B(4, -6)$. Find the equation of a line that exists such that every point on the line is the same distance from A as it is from B .

31.

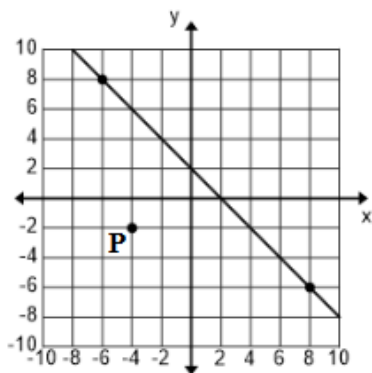
x	$-.5$	$-.2$	$-.1$	0	1	2
$f(x)$	10	$-.9$	$-.10$	$-.5$	$-.6$	$-.25$

Find the value of $f(-4)$.

32. If $s(x)$ is the slant asymptote of $h(x) = \frac{x^3+6}{2x^2+x-1}$, then $h(20) - s(20) = \text{-----}$. (nearest thousandth)
33. If $(x^3 - 9x^2 + kx - 12) \div (x - 1)$ has a remainder of zero, then $k = \text{-----}$.
34. Consider the sequence $3, 5, 8, 11, 15, 20, 27, 37, m, n, 111, \dots$. $m + n = \text{-----}$
35. Find the distance between the points $(3, 5, 7)$ and $(-4, 1, -3)$. (nearest tenth)
36. Jeremy has 49 coins with a total value of \$7.05. He only has nickels, dimes, and quarters. He has three more quarters than nickels. How many dimes does he have?
37. Find the distance between point A and the line shown on the right. (nearest tenth)



38. At Babe's in Sanger, we ordered four smoked chicken dinners for \$17.95 each, four iced teas for \$2.29 each and two slices of apple pie for \$4.25 each. The tax rate was 8.125% and I paid with one \$100 bill and one \$20 bill. I told the waitress to keep the change as a tip. How much was her tip?
39. Consider the line with points $(-3, -5)$ and $(5, 7)$. The line contains the point $(0, b)$. $b = \text{-----}$.
40. Joe sets the motor of his small boat to travel at its maximum speed. At this setting, he travels 36 miles upstream, against the current, in 9 hours and then turns around and travels 36 miles downstream, with the current, in 6 hours. What is the maximum speed of Joe's boat in still water?
41. Last summer, we drove from Lubbock, TX to McMinnville, OR to see relatives. On day 1, we drove 600 miles at an average speed of 62 mph. On day 2, we drove 620 miles at an average speed of 68 mph. On day 3, we drove 534 miles at an average speed of 60 mph. What was our overall average speed for the trip? (nearest tenth)
42. Jim can clean my pool in 75 min. Tom can clean my pool in 90 min. Julie can clean my pool in 60 min. If all three of them work together, how long would it take them to clean my pool? (nearest tenth)
43. Consider the line $y = f(x)$ which contains point P and is parallel to the line shown below. Find the value of $f(9)$.

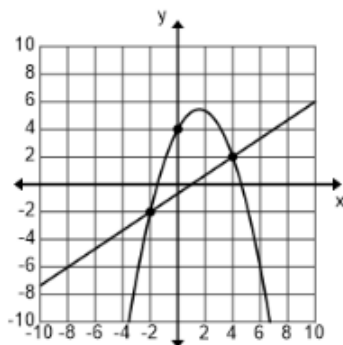


44. The UIL students at Latexo High School sold 246 tickets to the end of the year banquet. If adult tickets cost \$18, student tickets cost \$12, and \$3816 was raised, how many student tickets were sold?
45. Mary has 57 coins that are either nickels, dimes or quarters. The value of the coins is \$8.60. She has ten more quarters than nickels. How many dimes does she have?
46. Find the number that is $\frac{3}{4}$ of the way from $-1\frac{1}{2}$ to $6\frac{5}{8}$.
47. If $f(x) = \frac{2x+5}{3-7x}$, then $f^{-1}(2) = \text{-----}$.
48. Sixty workers could do 9 jobs in 6 days. How many days would it take 10 workers to do 12 jobs? (nearest tenth)
49. Consider the line $y = f(x)$ such that all points on the line are equidistant from the points $(-6, 8)$ and $(4, -6)$. The y -intercept of the line $y = f(x)$ is $(0, b)$. $b = \text{-----}$.
50. Find the domain of the function $f(x) = \frac{\sqrt{3+x}}{x^2-9x+20}$.
51. Solve the system

$$\begin{aligned} \frac{2}{5}a + \frac{3}{10}c &= 2\frac{1}{5} \\ -.5a + 1.5b &= 2.5.75a - 2.5c = -2 \end{aligned}$$

$$b = \text{-----}$$

52. The points of intersection of the curves shown on the right are P and Q . $PQ = \text{-----}$. (nearest tenth)



53.

Solutions

1. $2\frac{2}{5}$

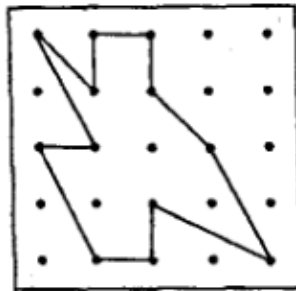
2. 22% less
3. \$4.15
4. 5
5. 180 km
6. $4 \log_b(6y)$
7. $(-1, -3)$
8. $y > x^2 - 3x + 4$
9. $28\frac{1}{8}$
10. 3
11. 256
12. .0625
13. 784 miles
14. 9
15. $3x - y = 2$
16. $-\frac{1}{64}$
17. A
18. -2
19. -39
20. -1620
21. 4
22. \$4.93
23. 2.0
24. 1225
25. 26
26. $\frac{chw+dh}{hm+kw}$
27. 200
28. $7\frac{1}{16}$
29. 33.8 mph
30. $5x - 8y = -21$
31. 55
32. 0.025
33. 20
34. 127
35. 12.8
36. 12
37. 14.3

- 38. \$23.27
- 39. -0.50
- 40. 5.0 mph
- 41. 63.3 mph
- 42. 24.3 min
- 43. -15
- 44. 102
- 45. 19
- 46. $4\frac{19}{32}$
- 47. $\frac{1}{16}$
- 48. 48.0 days
- 49. $\frac{12}{7}$
- 50. $x \geq -3, x \neq 4, 5$
- 51. 3
- 52. 7.2
- 53.

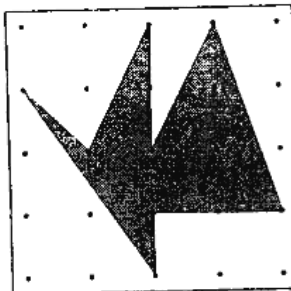
2 Geometry

Problems

1. The sides of a triangle are 9 in, 12 in, and 15 in. The triangle is a(n) _____triangle:
2. An isosceles trapezoid has a top base of 8 cm, a bottom base of 14 cm, and a slanted side length of 5 cm. Find the area of the isosceles trapezoid.
3. Rene drew $\triangle ABC$ using the coordinates $(1, 2)$, $(2, -2)$ and $(5, 1)$. Find the area of Rene's triangle.
4. Georg Alexander picks the special figure and places it on a five-peg-by-five-peg geoboard. Find the area enclosed by the figure.

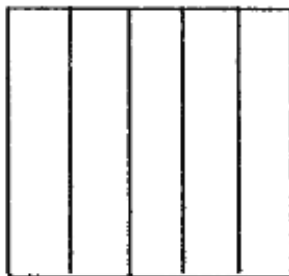


5. $\triangle DEF$ is an obtuse isosceles triangle such that $m\angle DEF$ is 104° and EF is 14 cm. Find the area of $\triangle DEF$ to the nearest integer.
6. Point $P(3, 3)$ is rotated 270° counterclockwise about the origin to point Q . Point Q is reflected across the y -axis to point R . Find the coordinates of point R .
7. Two chords, AC and BD intersect in the interior of a circle at point X such that $m\widehat{BC} = 20^\circ$ and $m\widehat{AD} = 120^\circ$. If points B and C are not on \widehat{AD} then $m\angle AXD$ is:
8. The adjacent dots on the grid are 1 cm apart when measured vertically and horizontally. Find the area of the shaded figure shown.

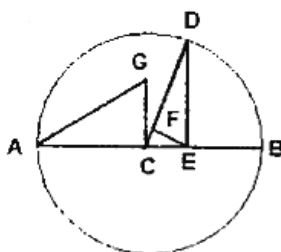


9. One of the base angles of an acute isosceles triangle has a measure of 50° and the length of its base is 6 cm. Find the perimeter of the acute isosceles triangle. (nearest tenth)

10. The square below is divided into 5 congruent rectangles. The perimeter of each of the congruent rectangles is 30 units. What is the perimeter of the square?

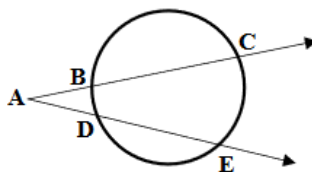


11. Simplify: $\frac{n!+(n-1)!}{(n-2)!}$
12. Let AB be the diameter of the circle with center C with $CG \perp AB$, $DE \perp AB$, and $EF \perp DC$. If $AE = 9$ and $BE = 4$ then $DE = ?$



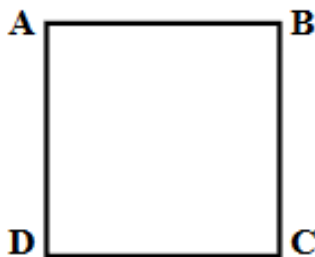
13. Given: $\triangle ABC \sim \triangle DEF$, $AB = 15$, $AC = 12$, $m\angle A = 62^\circ$, $DE = 10$. $EF = \dots\dots\dots$ (nearest tenth)
14. Points A and B line on a circle with center O . The area of the circle is 531 and $AB = 24$. Find the distance from O to chord \overline{AB} . (nearest tenth)
15. Consider a circle circumscribed about a regular pentagon. If the area of the circle is 452.4, then the area of the pentagon is $\dots\dots\dots$ (nearest whole number)

Use the sketch below for problems 16 and 17. The information given in problem 16 does not carry over to problem 17.

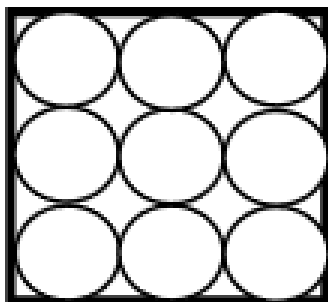


16. If $AB = 6$, $BC = 15$, and $AD = 8$, then $DE = \dots\dots\dots$ (nearest hundredth)
17. If $m\angle B = 28^\circ$ and $m\angle C = 86^\circ$, then $m\angle CAE = \dots\dots\dots^\circ$
18. The base of a pyramid is a square with each side equal to three-fifths of the height of the pyramid. If the volume of the pyramid is 700, what is the total area of the pyramid? (nearest whole number)
19. Angles A and B are complementary angles while angles A and C are supplementary angles. If $m\angle A = 6x + 1$ and $m\angle B = 9x - 1$, then $m\angle C = \dots\dots\dots^\circ$.

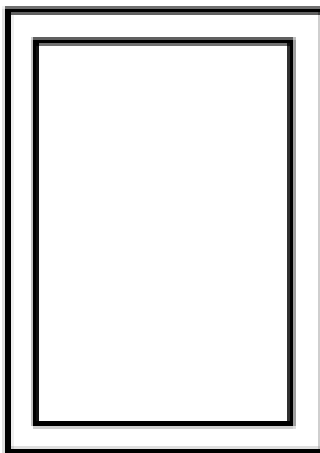
20. Quadrilateral $ABCD$ shown below is a square. The midpoint of \overline{AD} is point E and the midpoint of \overline{AB} is point F . If $EF = 18$, then the area of the square is _____.



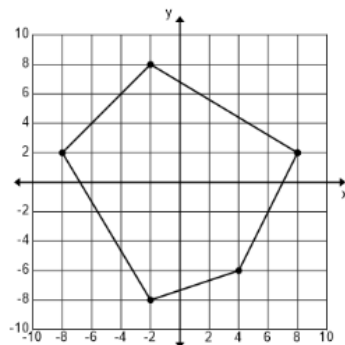
21. Consider a quadrilateral with vertices $A(-6, 4)$, $B(0, -8)$, $C(6, 4)$, and $D(0, 12)$. This quadrilateral can be classified as a _____.
22. Consider $\triangle ABC$ with point D on \overline{AB} such that $\overline{CD} \perp \overline{AB}$. If $m\angle ACB = 78.28^\circ$, $AD = 9$ and $CD = 12$, then $DB =$ _____. (nearest tenth)
23. Find the area of a triangle with vertices $(0, 12)$, $(0, 0)$ and $(12, 0)$.
24. If you cut nine circles out of a square piece of cardboard that measures 12 in by 12 in, how much cardboard is discarded? (nearest tenth)



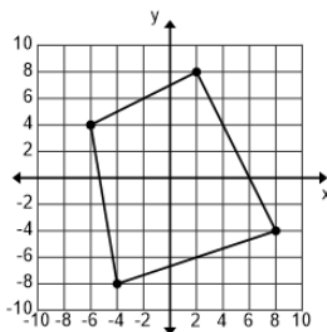
25. Russell's backyard pool is shaped like a rectangle that measures 30 ft by 50 ft. He decides to add a sidewalk that is 3 feet wide around the perimeter. Vedant, Caleb and Curtis will provide free labor, so he only has to pay for the concrete, which cost \$6.00 per square foot. What will the sidewalk cost?



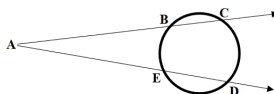
26. Find the area of the polygon below. (nearest whole number)



The following polygon is used for problem 27 and 28.



27. Find the perimeter of the polygon shown. (nearest tenth)
28. Find the area of the polygon shown.
29. Consider $\triangle ABC$ with $AB = 18$ and $BC = 14$. Point D lies on \overline{AC} such that \overline{BD} bisects $\angle ABC$. If $AD = 10$, then $DC = \rule{1cm}{0.4pt}$. (nearest tenth)
- Use the following sketch for problems 30 and 31.



30. If $m\angle CAD = 19^\circ$, $m\angle C = 120^\circ$, $m\angle DE = 102^\circ$, then $m\angle BC = \rule{1cm}{0.4pt}$.
31. If \overline{BD} intersects \overline{CE} at point P (not shown) with $BP = x + 1$, $CP = 2x$, $DP = 2x + 2$, and $EP = x + 4$, then $CE = \rule{1cm}{0.4pt}$. (nearest tenth)
32. Consider a right circular cone with a base perimeter of 75 cm and a lateral area of 490 cm. Find the volume of the cone. (nearest whole number)
33. Consider a circle inscribed in a square with side lengths 44.6 mm. Find the area inside the square but outside the circle. (nearest whole number)
34. Find the perimeter of a regular decagon that can be inscribed in a circle with an area of 254 cm^2 . (nearest tenth)
- 35.

Solutions

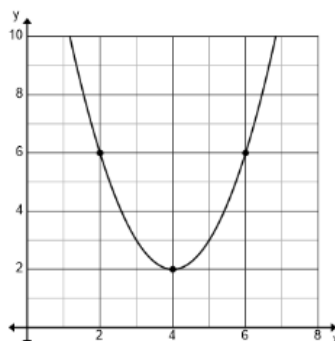
1. Right

2. 44 cm^2
3. 7.5 units^2
4. 8 units^2
5. 95 cm^2
6. $(-3, -3)$
7. 70°
8. 6 cm^2
9. 15.3 cm
10. 50 units
11. $n^2 - 1$
12. 6
13. 9.4
14. 5.0
15. 342
16. 7.75
17. 29°
18. 523
19. 143
20. 648
21. kite
22. 10.6
23. 72
24. 30.9 in^2
25. \$3096.00
26. 148
27. 47.2
28. 136
29. 7.8
30. 56°
31. 5.5
32. 793 cm^3
33. 427 mm^2
34. 55.6 cm
- 35.

3 Pre-Calculus

Problems

1. The graph of $x^2 + y^2 - 4x + 12y + 30 = 0$ is a circle with a diameter of:
2. Let $\tan A = \frac{7}{24}$, where A is in QIII. Find $\cos A$.
3. An equivalent expression for $(\sin x + \cos x)^2 + (\sin x - \cos x)^2$ is:
4. The graph of $x^2 + y^2 + 10x - 12y - 20 = 0$ is a circle with a radius of:
5. A cliff near a lake is 125 feet high. The angle of depression of a canoe from the top of the cliff is 30° . How far is the canoe from the base of the cliff? (nearest foot).
6. Simplify: $\sin \theta \tan \theta + \cos \theta$
7. Use the angle of rotation, θ (nearest degree), where $0^\circ < \theta < 90^\circ$, to transform the conic $xy = 1$ into an equation that is in standard position and does not contain an xy term. The transformed equation is:
8. The focus of the parabola below has coordinates (a, b) . $a + b = \underline{\hspace{2cm}}$.



9. Find the eccentricity of the ellipse. $9x^2 + 16y^2 - 36x + 96y + 36 = 0$. (nearest hundredth)
10. Simplify: $4 \csc(2x) \cos(x)$
11. Polonium 221 has a half-life of 130 seconds. How long will it take a sample with a mass of 1.80 g to decay to a mass of 1.20 g? (nearest tenth)
12. Assume the number of hours of daylight varies sinusoidally at the Clydehurst Christian Ranch in Montana. The longest day of the year has 15 hr 30 min of daylight and the shortest day has 8 hr 30 min of daylight. How many days during the year have at least 13 hours of daylight?
13. The Holiday Inn is across the street from the Hilton. The hotels are 120 feet apart. Joe looks out the window of his room at the Holiday Inn and notices that the angle of depression to the base of the Hilton is 36° and the angle of elevation to the top of the Hilton is 44° . How tall is the Hilton? (nearest foot)
14. The graph of $r = 3 - 3 \sin \theta$ is a _____.
15. The graph of the parametric equations $x = 2 + 3 \cos \theta$ and $y = 1 + 2 \sin \theta$ is an ellipse with vertices (a, b) and (c, b) . $a + c = \underline{\hspace{2cm}}$.
16. If $\frac{12i+8i^4+12i^3}{\sqrt{-100+10i+6i^4}}$ simplifies to $\frac{a}{b} + \frac{c}{b}i$, then $a + b + c = \underline{\hspace{2cm}}$.

17. If $f(x) = \sec(2x)$ and $h(x) = \csc(3x)$. $f\left(\frac{5\pi}{8}\right) + h\left(\frac{11\pi}{18}\right) = \text{-----}$. (nearest tenth)
18. Each of the wheels on Russell's jumbo wheel swamp buggy has a 4 ft diameter. When he is traveling 42 mph, what is the angular velocity of the wheels in revolutions per minute? (nearest whole number)
19. The vertex of the parabola $y = -4x^2 + 6x - 8$ is the point (a, b) . $a + b = \text{-----}$. (nearest hundredth)
20. Multiply $(6 \operatorname{cis}(60^\circ))(-4 \operatorname{cis}(-150^\circ))$ and express the result in rectangular form.
21. Sarah released 36 bunnies into the woods near her house. Six months later the population had increased to 100 bunnies. Assume the bunny population is increasing exponentially and calculate the expected bunny population 21 months after the original release of 36 bunnies.
22. Devin drops a ball from a height of 24 feet. On each bounce, the ball rebounds three-fourths of the distance it fell. How far does the ball rebound on the tenth bounce? (nearest inch)
23. Consider $f(x) = x^3 + bx^2 + cx + d = 0$. Two of the zeroes are 5 and $2i$. $|b + c + d| = \text{-----}$.
24. The vertices of the hyperbola $16y^2 - 9x^2 - 96y - 72x - 144 = 0$ are (a, b) and (a, c) . $b + c = \text{-----}$.
25. Consider a parabola with vertex $\left(\frac{3}{2}, \frac{1}{4}\right)$. If the point $(-2, 4)$ lies on the graph of the parabola, which of the following points also lies on the graph of the parabola? The graph is concave up.
 (A)(2, -2) (B)(3, 0) (C)(4, 2) (D)(5, 4) (E)(6, 6)
26. Find the angle between the line $3x - y = 6$ and the line $4x + 5y = 9$. (nearest tenth)
27. The graph of the polar equation $r = 3 - 3\cos(\theta)$ is a -----.
28. The graph of the parametric equations $x = 13\cos(\theta)$ and $y = 5\sin(\theta)$ is an ellipse with a foci (a, b) and (c, b) . $|a - c| = \text{-----}$.
29. Consider the sphere $x^2 + y^2 + z^2 + 4x - 6y + 2z - 11 = 0$. Find the volume of the sphere. (nearest tenth)
30. The unit vector orthogonal to both $u = 2i - 3j + 4k$ and $v = -2i + 5j - 7k$ is the vector $\frac{a}{\sqrt{53}}i + \frac{b}{\sqrt{53}}j + \frac{c}{\sqrt{53}}k$.
 $a + b + c = \text{-----}$.
- 31.

Solutions

1. 6.3 units
2. $-\frac{24}{25}$
3. 2
4. 9
5. 217 ft
6. $\sec \theta$
7. $x^2 - y^2 = 2$
8. $6\frac{1}{4}$
9. 0.66
10. $2 \csc(x)$
11. 76.0 s
12. 148
13. 203 ft

14. cardioid

15. 4

16. 81

17. -3.4

18. 294 rpm

19. -5.00

20. $24i$

21. 1286

22. 16 in

23. 21

24. 6

25. D

26. 69.8°

27. cardioid

28. 24

29. 523.6

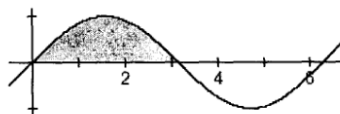
30. 11

31.

4 Calculus

Problems

1. Find the area of the shaded region (nearest square unit)



2. Which of the following sequences is divergent?

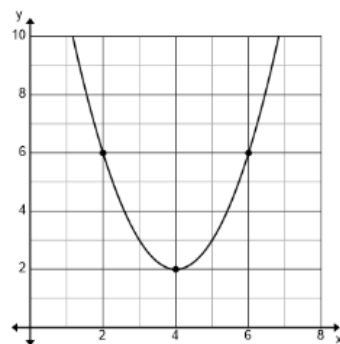
(A) $\left\{ \frac{2n+1}{3n-2} \right\}$ (B) $\left\{ \frac{-1^n}{n^2+n} \right\}$ (C) $\left\{ \frac{(-1)^n(n+1)}{n+2} \right\}$ (D) $\left\{ \frac{4n^2-n^3}{10+2n^3} \right\}$ (E) $\left\{ \frac{6n^2+3n-1}{n^2+8n+16} \right\}$

3. If $f'(x) = 6x^2 - 4x + 1$ and $f(1) = 0$, find $f(-1)$.

4. $f(x) = 2x^3 - 6x + 1$ has an inflection point at:

5. Find the area (in square units) of the region bounded by $x = \frac{y^2+2}{2}$ and $x = y + 5$.

6. The graph of $f'(x)$ is shown below. If $f(1) = 2\frac{1}{3}$, then $f(2) = \dots\dots\dots$

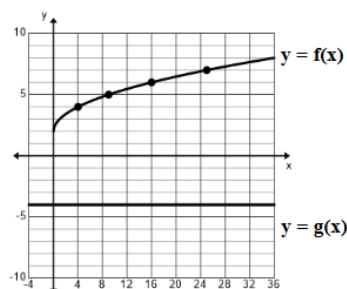


7.

x	-3	-2	-1	0	1	2
$f(x)$	10	-9	-10	-5	-6	-25

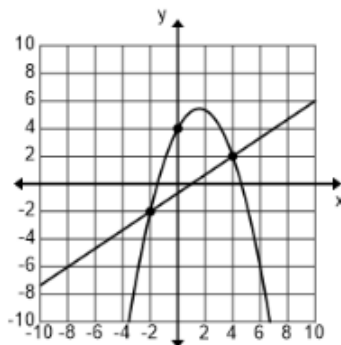
The point of inflection for the graph of $f(x)$ has coordinates (a, b) . $a + b = \dots\dots\dots$ (nearest tenth)

The following graph is used for problems 8 and 9.



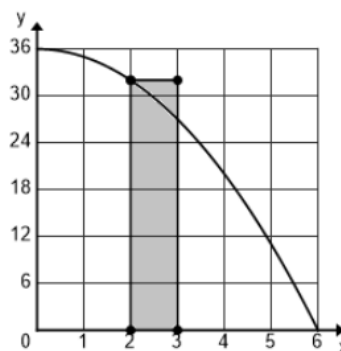
8. Find the area between the curves $y = f(x)$ and $y = g(x)$ shown on the right over the interval $[4, 24]$. (nearest whole number)

9. Find the volume of the solid generated by revolving the region bounded by $y = f(x)$, the x -axis, the line $x = 4$ and the line $x = 24$ about the line $y = g(x)$. (nearest whole number)
10. Find the area of one petal of the rose curve $r = 6 \cos(2\theta)$. (nearest tenth)
11. Find the interval of convergence for the power series $\sum_{n=1}^{\infty} \frac{(-1)^{n+1} x^n}{4^n}$.
12. Find the value of c in the open interval $(-8, 2)$ that satisfies the mean value theorem for the function $f(x) = \sqrt{6 - x}$. (nearest hundredth)
13. If you were going to evaluate $\int \frac{\cos x}{\sin^3 x} dx$ using u -substitution, the best choice for u is _____.
14. If $f(x) = x^2 - 8x + 9$, then $\frac{f(x+h) - f(x)}{h} = \text{_____}$.
15. Find the area bounded by the two curves shown below. (nearest tenth)



16. Consider the function $f(x) = \frac{1}{2} \cos(2x) + \frac{3}{2} \sin(x)$. Find the slope of the line tangent to the graph of $y = f(x)$ when $x = \pi$. (nearest tenth)
17. A balloon is rising straight up from a point on the ground 150 feet from a curious mouse. If the balloon is rising at a rate 8 ft/s, what is the rate of change of the angle of elevation of the balloon from the mouse when the balloon is 200 ft above the ground. (nearest hundredth)
18. A rectangular solid with a square base has a total surface area of 330 in^2 . Find the maximum volume possible for such a solid. (nearest tenth)

Use the following graph for questions 19 and 20.



19. Find an approximation of the area bounded by the graph of $f(x) = 36 - x^2$ and the x -axis between $x = 1$ and $x = 5$. Use four rectangles of equal width and find the height of each rectangle using the left endpoint of the interval. One of the rectangles is shown above.
20. Find the exact area of the region bounded by the graph of $f(x) = 36 - x^2$ and the x -axis between $x = 1$ and $x = 5$. (nearest tenth)
21. Find the derivative of $F(x)$ if $F(x) = \int_0^{4x} \sin(t) dt$.

22. When evaluating $\int x^2 \cos(x) dx$ using a u -substitution, the best choice for u is
23. Let $f(x) = \sin(x)$ and let $P_5(x)$ be the fifth Maclaurin polynomial for $f(x) = \sin(x)$. Find the value of $|P_5(\frac{\pi}{6}) - f(\frac{\pi}{6})|$. (nearest ten-millionth)
24. Find the length of the arc from $\theta = \frac{\pi}{6}$ to $\theta = \frac{\pi}{3}$ for the polar curve $r = 4 - 4 \cos(\theta)$. (nearest tenth)
- 25.

Solutions

1. 2
2. C
3. -6
4. $(0, 1)$
5. 18
6. $10\frac{2}{3}$
7. -8.0
8. 193
9. 4890
10. 14.1
11. $(-4, 4)$
12. -2.24
13. $\sin x$
14. $2x + h - 8, h \neq 0$
15. 21.0
16. -1.5
17. 0.02 rad/s
18. 407.9 in^3
19. 114
20. 102.7
21. $4 \sin(4x)$
22. x^2
23. 0.0000021
24. 1.6
- 25.

5 Statistics

Problems

1. A box contains 5 green balls, 4 blue balls, and 3 red balls. Two balls are randomly selected, one at a time, without replacement. What is the probability that both are blue?
2. If two dice are rolled at one time, what is the probability that both dice show a prime number?
3. Over the last few years, the length of Randy's drives at the local driving range follows a normal distribution with a mean of 225 yards and a standard deviation of 6 yards. Approximately what percentage of his drives are between 219 yards and 231 yards? (nearest whole number)
4. A fair die is rolled four times. What is the probability of getting an even number, a prime number, a Fibonacci number, and a perfect number, in that order?
5. Mel is throwing darts at a circular target with a diameter of 24. On the target are two concentric circles with diameters 8 and 16. A dart landing in the small circle earns 10 points. A dart landing inside the circle with a diameter of 16, but outside the small circle earns 6 points. A dart landing on the target outside of the two concentric circles earns 2 points. Find the expected value of the points earned on any randomly selected toss that lands on the target. (nearest tenth)

Use the table below for problems 6 and 7. Karen owns the Kwik Stop in Sundown. She believes that the number of water bottles sold each day varies with the temperature. She made a table of the high temperature and the number of water bottles sold on the 15th day of the month, for the months of April through September.

Temperature	64°	72°	86°	94°	96°	92°
Bottles Sold	420	450	500	530	540	520

6. Find the sum of the mean, median, and range for the number of water bottles sold on these six days.
7. Use the data from the table to create an appropriate mathematical model and predict the high temperature on a day that Karen sold 354 water bottles. (nearest whole number)
8. The preferred swimming pool temperature of adult females follows a normal distribution with a mean of 82° F with a standard deviation of 3° F. Find the probability that a random selected adult female will prefer a temperature between 26° C and 29° C. (nearest thousandth)
9. A researcher took a random sample of 1,000 teenage males in order to estimate the mean number hours of sleep a typical teenage boy gets each night. A 90% confidence interval would be _____than a 98% confidence interval and would involve _____risk of being incorrect.
10. A one-sample t statistic from a sample of 40 observations for the two-sided test of

$$H_0 = 26 \quad H_a \neq 26$$

has the value $t = -1.44$. Find the p -value for this test. (nearest thousandth)

11. When analyzing data, statisticians often report the five-number summary. Which of the following are included in the five-number summary?
I. mean II. standard deviation III. median IV. quartiles V. maximum and minimum
12. A shipment of twenty refurbished computers contains four defective computers. In how many ways can Rocket purchase five of these computers and get two defective ones?

13. James has 6 calculus books and 8 physics books on his bookshelf at home. How many arrangements are possible if he keeps the calculus books together and the physics books together?

	Math	English	Science	History	Elective 1	Elective 2
Freshman	94	92	96	98	97	95
Sophomore	93	94	97	99	95	91
Junior	95	93	98	97	96	93

Use the table above for problems 14 and 15.

The table shows the grades for Carolyn her first three years at HPHS.

14. What is Carolyn's cumulative average after three years of school? (nearest hundredth)
15. If Carolyn needs to have a cumulative average of 95.45 or higher to graduate in the top 10, what is the minimum average required during her senior year to meet this goal? She plans to take 6 courses her senior year. (nearest hundredth)
16. Suppose the distribution of the heights of adult males in Nevada is approximately normal with a mean height of 70 inches and a standard deviation of 2.7 inches. A height of 72 inches corresponds to what percentile in the distribution?

	1	2	3	4	5	6	7
Time (wk)	0	2	5	8	11	14	17
Population	12	47	388	3060	24600	200000	1580000

Use the table above for problems 17 and 18.

Sam was doing research for his master's thesis at Harvard. He estimated the population of an isolated group of flies at seven different times. He started at $t = 0$ with 12 flies. He finished at $t = 17$ weeks with 1,580,000 flies.

17. Sam entered the data into a list he called L_1 and the populations into a list he called L_2 on his computer. Which of the following transformation equations will linearize the data?
- (A) $(L_1, (L_2)^3)$ (B) $((L_1)^3, L_2)$ (C) $(\log(L_1), L_2)$ (D) $(L_1, \log(L_2))$ (E) $(\log(L_1), \log(L_2))$
18. Sam was successful in using one of the transformations listed in problem 17 to calculate a regression equation that fit the data. Use this equation to predict how many days after $t = 0$ that the population reaches 100,000 flies. (nearest tenth)
19. Four-hundred students at Texas Tech were randomly selected and asked if they had worked out at the Recreation Center by using a treadmill or an elliptical trainer the past week. The results showed that 75 had worked out on both, 190 had worked out on a treadmill, and 260 had worked out on an elliptical trainer. How many of the 400 students sampled had not worked out on either training device the previous week?
20. Amarillo Slim was playing five card poker. He had a full house, but lost to the dealer who had a royal flush. This is where a player has the ten, jack, queen, king and ace of the same suit. Slim thought the dealer was cheating because the probability of being dealt a royal flush from a standard deck of 52 cards is only _____. (9 decimal places)
21. Assume that Luka Doncic makes 35.3% of his 3-point shots regardless of the opponent or where the game is being played. He is unaffected by previous attempts. If he attempts ten 3-points shots in a game, what is the probability that he makes 4, 5, or 6 of the shots? (nearest thousandth)
22. A survey asked a random sample of 500 U.S. teenagers whether music from the 1970s is superior to music from the 2020s. Of the sample, 312 responded with "yes". Construct a 95% confidence interval for the proportion of U.S. teenagers who would say "yes" if asked this question.
23. The average lifetime of battery packs for the Williams Electric vehicle was 4.9 years in 2004. In 2012, they introduced a new battery pack that they believed would last longer. A simple random sample of 50 of the 2012 vehicles with the new battery packs was selected. The mean lifetime of the battery packs turned out

to be 5.1 years with a standard deviation of 0.86 years. An appropriate test was performed and the resulting P -value was (nearest thousandth)

24.

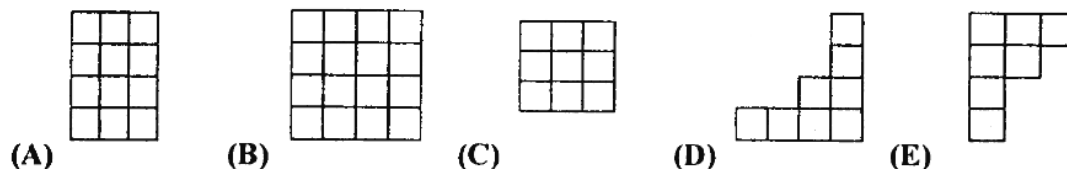
Solutions

1. $\frac{1}{11}$
2. 25%
3. 68%
4. $\frac{1}{36}$
5. 4.2
6. $1123.\bar{3}$
7. 46°
8. 0.625
9. narrower, a greater
10. 0.158
11. III, IV, V
12. 3360
13. 58,060,800
14. 95.17
15. 96.30
16. 77th
17. D
18. 91.1 days
19. 25
20. .000001539
21. 0.467
22. (.5815, .6665)
23. 0.053
- 24.

6 Extra Topics

Problems

- Which equality axiom of addition is demonstrated by $(ax + by) + c = ax + (by + c)$?
- The relation $(0, 0), (2, 2), (2, -2), (6, 8), (6, -8)$ is:
- Which of the following numbers is considered to be an “abundant” number?
(A)26 (B)28 (C)30 (D)32 (E)34
- Let $A = \begin{bmatrix} 1 & -2 \\ 1 & -3 \end{bmatrix}$ and $B = \begin{bmatrix} -3 & 2 \\ -1 & 1 \end{bmatrix}$ and $AB = \begin{bmatrix} W & X \\ Y & Z \end{bmatrix}$. What is the determinant of AB ?
- Which of the following is true about the relation $h(x) = 5 - x^2$?
- Which of the following would best represent a two dimensional perspective of the top view of this figure shown?



- Which of the following is not one of the fourth roots of $16(\cos 120^\circ + i \sin 120^\circ)$?
(A) $-\sqrt{3} - i$ (B) $\sqrt{3} + i$ (C) $1 - \sqrt{3}i$ (D) $-\sqrt{3} + i$ (E) $-1 + \sqrt{3}i$
- Consider the sequence $17, 21, 25, 29, 33, 37, \dots, 129, 133$. Find the sum of the terms of the sequence.
- $ABC_{16} + ABC_{15} = \text{-----}_{14}$
-

Solutions

- Associative
- not a function
- C

4. 1
5. even function
6. A
7. D
8. 2250
9. 21411
- 10.

7 Tips and Strategies