1. Carla treated her friend to lunch at Joey's in Wichita Falls. They ordered the #14 special plate for $8.95, the #11 special plate for $8.75, guacamole to share for $4.65, and two drinks for $2.25 each. The tax rate in Wichita Falls is 8.125%, Carla tipped 20% on the pre-tax total, and she paid with a $50 bill. How much change did she receive?

(A) $15.16 (B) $15.29 (C) $17.14 (D) $15.60 (E) $15.48

2. Consider the line segment with endpoints A(–5, 3) and B(6, 1). Which of the following is an equation of the perpendicular bisector of $\overline{AB}$? mp: $(\frac{1}{2}, 2)$, slope $= \frac{3-1}{-5-6} = -\frac{2}{11}$, $m_\perp = \frac{11}{2}$

(A) $2x+11y=21$ (B) $22x-4y=3$ (C) $2x+11y=23$ (D) $22x-4y=19$ (E) $2x-11y=23$

3. Lynn pilots her plane for 320 miles against the wind in 2 hours. The same flight would have taken 1 hr 36 min if she flew with a tailwind of the same speed. Find the speed of the plane in still air.

$(s+t)1.6=(s-t)2 \Rightarrow 1.6s=3.6t \Rightarrow s=9t$

(A) 180 mph (B) 162 mph (C) 198 mph (D) 150 mph (E) 172 mph

$(10t)1.6=320 \Rightarrow t=20 \Rightarrow s=180$

4. Ilia has a large irrigation water tank in the shape of an inverted cone with a base diameter of 6 ft and a height of 10 ft. If she started with the tank completely empty, and added 400 gallons of water, what was the depth of the water in the tank? (nearest inch)

(A) 6 ft 8 in (B) 7 ft 2 in (C) 7 ft 11 in (D) 8 ft 3 in (E) 8 ft 9 in

5. Heather is solving the quadratic equation $x^2-5x+8=0$ by completing the square. Her second step is $x^2-5x+c=-8+c$. The value of $c$ is _____. $ax^2+bx+\_\_ \Rightarrow (\frac{-5}{2})^2$; $ax^2+bx+(\frac{b}{2})^2$

(A) 25 (B) 16 (C) $\frac{25}{4}$ (D) $\frac{25}{2}$ (E) $\frac{16}{25}$

6. The perimeter of triangle ABC show on the right is ____. (nearest tenth) $\sqrt{109}+\sqrt{65}+\sqrt{106}$

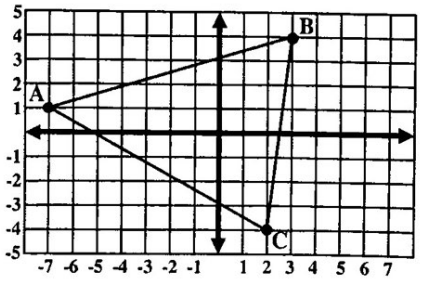
(A) 27.2 (B) 27.5 (C) 27.9 (D) 28.3 (E) 28.8

(-7,1) (3,4) (2,-4) (-7,1)

7. The area of triangle ABC is _____. (nearest tenth)

$2\times Area = |[-28+(-12)+2]-[7+8+28]| = |-38-39| = 77 \Rightarrow A: 38.5$

(A) 38.5 (B) 37.2 (C) 35.5 (D) 40 (E) 38




Problems 6, 7, 8

8. The coordinates of the midpoint of $\overline{BC}$ are (a,b). a + b = _____. (nearest tenth) (2.5, 0)

(A) 2 (B) 2.1 (C) 2.5 (D) 2.8 (E) 3

9. Find the number that is $\frac{1}{3}$ of the way from $-4\frac{7}{9}$ and $2\frac{1}{2}$. $\left|-\frac{79}{9}-\frac{5}{2}\right| = \frac{185}{18}$, $\frac{1}{3}$ =

(A) $-\frac{127}{27}$ (B) $-\frac{71}{54}$ (C) $-\frac{127}{54}$ (D) $-\frac{16}{27}$ (E) $-\frac{16}{54}$

10. If $f(x)=x+1$ and $g(x)=\frac{3}{x}$, find $g\left(f^{-1}(x)\right)$. $f^{-1}(x)=x-1$ $g(f^{-1})=\frac{3}{x-1}$

(A) $\frac{x-1}{x+3}$ (B) $\frac{3}{x-1}$ (C) $\frac{3}{x+3}$ (D) $\frac{x+3}{x-1}$ (E) $\frac{x+3}{x}$

11. A triangle has a perimeter of 237 m and an area of 171 m$^2$. A similar triangle has a perimeter of 79 m. The area of the similar triangle is _____m$^2$. $\left(\frac{237}{79}\right)^2=\frac{171}{x}$

(A) 38 (B) 19 (C) 110 (D) 114 (E) 57

Problems 12-13. The base of a pyramid is square with each side equal to 20 cm. The slant height is 18 cm.

12. The lateral surface area of the pyramid is _____cm$^2$. (nearest whole number) $4\left(20\cdot 18\cdot\frac{1}{2}\right)$

(A) 360 (B) 748 (C) 352 (D) 374 (E) 720

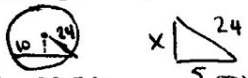
13. The volume of the pyramid is _____cm$^3$. (nearest whole number) $18^2-10^2=\sqrt{224}=h$

(A) 1729 (B) 1200 (C) 1248 (D) 1996 (E) 1800

14. There are two possible triangles ABC such that m∠A = 30°, AB = 12 cm and BC = 8 cm. The area of the smaller triangle is _____cm$^2$. (nearest tenth) TRISOLVE program

(A) 15.3 (B) 55.4 (C) 13.9 (D) 41.6 (E) 47.1

15. A circle with a radius of 24 in has a center at the point Q. How far from Q is a chord of the circle that has a length of 10 in? (nearest tenth inch )




(A) 10.9 in (B) 26.5 in (C) 23.5 in (D) 13.3 in (E) 21.8 in

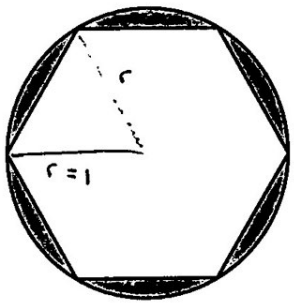
16. Four workers can paint a wall in 20 minutes. How long will it take six workers at the same individual rate to paint a wall three times as long and three times as high? $\frac{4\cdot 20}{1}=\frac{6\cdot t}{9}$

(A) 40 min (B) 60 min (C) 120 min (D) 90 min (E) 180 min

17. Ashlee's SUV gets 18 miles per gallon in city driving and 24 miles per gallon in highway driving. She drove the SUV 465 miles on 23 gallons of gas. How many miles were driven on the highway? $\begin{bmatrix} c & h & 23 \\ 18c & 24h & 465 \end{bmatrix}$

(A) 260 (B) 204 (C) 205 (D) 261 (E) 212

18. A dart lands randomly on the figure composed of a regular hexagon inscribed in a circle as shown. What are the odds that it lands in the shaded region? (nearest thousandth)




(A) 0.173 (B) 0.346 (C) 0.209 (D) 0.413 (E) 0.827

$A_{Hexagon}=6\left(\frac{1^2\sqrt{3}}{4}\right)$ odds $=\frac{\pi-\frac{3}{2}\sqrt{3}}{\frac{3}{2}\sqrt{3}}$

$A_{circle}=1^2\pi=\pi$

19. The area of a 30°- 60°- 90° triangle is 432 in². The length of the shorter leg is_____in. (nearest tenth)

$x$, $2x$, $x\sqrt{3}$ $\quad A=\frac{1}{2}bh=\frac{1}{2}(x)(x\sqrt{3})=432$ $\quad x=\left(\frac{432\cdot 2}{\sqrt{3}}\right)^{1/2}$

(A) 22.3 (B) 24.7 (C) 23.1 (D) 21.8 (E) 22.0

20. The diameter of each tire on my car is 27 inches. If I drive at a constant speed of 100 kph for 10 minutes, how many revolutions will each tire make during this 10-minute period? (nearest whole number) Distance = 16 km or $16\frac{2}{3}$ km Revolutions $=(16\frac{2}{3}\cdot 10000)/(27\pi\cdot 2.54)$ Tire circ. $=27\pi(2.54)$ cm

(A) 76349 (B) 8483 (C) 25450 (D) 7736 (E) 8231

21. Find the eccentricity of the ellipse $x^2+4y^2-6x-16y-11=0$. (nearest hundredth)

$(x-3)^2+4(y-2)^2=36$

(A) 0.71 (B) 0.87 (C) 0.35 (D) 0.43 (E) 0.82

$\frac{(x-3)^2}{36}+\frac{(y-2)^2}{9}=1$ $\quad e=\frac{c}{a}=\frac{\sqrt{36-9}}{6}$

22. If $f(x)=\sqrt{x}$, then $\dfrac{f(x+h)-f(x)}{h}=$_____.

(A) $\dfrac{1}{\sqrt{x+h}-\sqrt{x}}$ (B) $\dfrac{h}{2\sqrt{x}}$ (C) $\dfrac{1}{\sqrt{x+h}+\sqrt{x}}$ (D) $\dfrac{1}{2\sqrt{x}}$ (E) $\dfrac{-h}{\sqrt{x+h}-\sqrt{x}}$

23. If $\log 9=P$ and $\log 5=Q$, then $\log 0.6=$_____.

(A) $\dfrac{PQ}{2}$ (B) $2PQ$ (C) $\dfrac{\sqrt{P}}{Q}$ (D) $\log\dfrac{\sqrt{P}}{Q}$ (E) $\dfrac{P-2Q}{2}$

24. Connie is one of the children in a large family. She has twice as many brothers as she has sisters. Another child, Paul, has the same number of brothers as he has sisters. How many children are in the family?

(A) 4 (B) 5 (C) 6 (D) 7 (E) 8

25. $\displaystyle\sum_{k=0}^{12} 2k(k+3)=$_____.

(A) 1768 (B) 884 (C) 2184 (D) 1807 (E) 1416

26. $\dfrac{1-\cos 2\theta}{\sin 2\theta}=$_____. $\quad \dfrac{1-(\cos^2\theta-\sin^2\theta)}{2\sin\theta\cos\theta}=\dfrac{\overbrace{1-\cos^2\theta}^{\sin^2\theta}+\sin^2\theta}{2\sin\theta\cos\theta}=\dfrac{2\sin^2\theta}{2\sin\theta\cos\theta}=\dfrac{\sin\theta}{\cos\theta}=\tan\theta$

(A) $\tan 2\theta$ (B) $\csc 2\theta$ (C) $\sec\theta$ (D) $\tan\theta$ (E) $\cos\theta$

27. If $\sec\theta=-3$ and $\sin\theta>0$, then $\tan\theta=$_____. $\quad \theta$ in QII $\quad 2\sqrt{2}, 3, -1$

(A) $-2$ (B) $2\sqrt{2}$ (C) $\dfrac{8}{3}$ (D) $-2\sqrt{2}$ (E) 2

28. An investor has \$12000 to split between two bonds that pay 10.5% and 12% simple interest. The investor wants annual interest of \$1400. What is the most that can be invested in the 10.5% bond?

(A) \$1444.00 (B) \$9333.33 (C) \$2666.66 (D) \$867.00 (E) \$8667.00

$(12000-x)(.12)+(x)(.105)=1400$

29. In how many ways can five couples be seated at a round table if the men and women want to sit alternately? Assume couples do not need to sit together. $-X-X-X-X-X$ $5!(5-1)!$

(A) 144 (B) 1440 (C) 288 (D) 576 (E) 2880

30. If $x-y=7$ and $xy=3$, then $x^3-y^3=$_____. $(x-y)(x^2+xy+y^2) = 7(7^2+3(3))$

(A) 385 (B) 427 (C) 343 (D) 112 (E) 406

31. If $(3-5i)^2-(2+5i)^3=a+bi$, then $a+b=$_____.

(A) –47 (B) 161 (C) –253 (D) –45 (E) 126

32. Multiply $\left(5\text{cis}\frac{\pi}{6}\right)\left(\sqrt{2}\text{cis}\frac{\pi}{2}\right)$ and express the result in rectangular form. $5\sqrt{2}\left(\cos\frac{\pi}{6}+i\sin\frac{\pi}{6}\right)\left(\cos\frac{\pi}{2}+i\sin\frac{\pi}{2}\right)$

(A) $\frac{5\sqrt{2}}{2}-\frac{5\sqrt{6}}{2}i$ (B) $\frac{5\sqrt{2}}{2}-\frac{5\sqrt{3}}{2}i$ (C) $-\frac{5\sqrt{2}}{2}+\frac{5\sqrt{6}}{2}i$ (D) $\frac{5\sqrt{2}}{2}-\frac{5\sqrt{2}}{2}i$ (E) $\frac{5\sqrt{2}}{2}+\frac{5\sqrt{2}}{2}i$

33. The point $(-8,b)$ lies on the curve defined by the parametric equations $\begin{matrix}x=6-t\\y=t+9\end{matrix}$. $b=$_____. $-8=6-t \Rightarrow t=14$ $y=(14)+9=23$

(A) 23 (B) –5 (C) 14 (D) 5 (E) –9

34. Find the total number of diagonals that can be drawn from the vertices of a regular dodecagon. $\text{Diagonals} = \frac{n(n-3)}{2}$

(A) 78 (B) 66 $\frac{12(12-3)}{2}$ (C) 72 (D) 36 (E) 54

35. Find the distance from the point $(\overset{x_0}{4},\overset{y_0}{-1},\overset{z_0}{2})$ to the line $\overset{A}{2}x-\overset{B}{2}y+\overset{C}{z}=\overset{D}{21}$. $\text{distance} = \frac{|Ax_0+By_0+Cz_0-D|}{\sqrt{A^2+B^2+C^2}}$

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

36. Classify the graph of $3x^2+8xy+4y^2-7=0$. $Ax^2+Bxy+Cy^2-F=0$ $B^2-4AC$ $\begin{cases}=0, \text{circle or ellipse}\\>0, \text{hyperbola}\\<0, \text{parabola}\end{cases}$

(A) Hyperbola (B) Cartoid (C) Parabola (D) Ellipse (E) Circle

37. Due to improved conservation efforts, the elephant population in South Africa's Kruger National Park has increased from 1300 in 1995 to 8870 in 2022. Assume that the population is growing exponentially and that the habitat can accommodate the continued growth. Calculate the expected elephant population in 2030. $y=ab^x=P_i(1+x)^t$

(A) 14728 (B) 15209 (C) 15669 (D) 15831 (E) 16207

38. Two of the zeros of $f(x)=x^4+bx^3+cx^2+dx-5$ are $1+\sqrt{2}$ and $2+i$. $f(-1)=$_____.

(A) 15 (B) 20 (C) 22 (D) 25 (E) 30

Zeroes: $(1+\sqrt{2}), (1-\sqrt{2}), (2+i), (2-i)$ $(x-(1+\sqrt{2}))(x-(1-\sqrt{2}))(x-(2+i))(x-(2-i))$ $[(x-1)-\sqrt{2}][(x-1)+\sqrt{2}][(x-2)-i][(x-2)+i]$ $(x^2-2x-1)(x^2-4x+5)$

39. Assume that the earth rotates about its axis every 23 hours, 56 minutes and 4 seconds. Find the linear speed of a person sitting in a chair at 10° north latitude. The radius of the earth is 3960 miles. (nearest whole number) $3960\cos(10°)\cdot 2\pi = \text{Circumference}$ $\frac{C}{t} = \frac{C}{(86400-236)3600}$

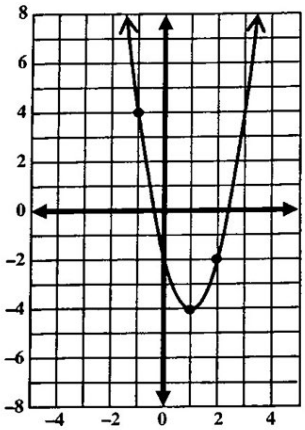
(A) 1036 mph (B) 968 mph (C) 1016 mph (D) 1040 mph (E) 1024 mph

40. Find the acute angle between the line $3y = x - 7$ and $2y = 3 - 4x$. (nearest tenth) $\tan\theta = \left|\frac{m_1 - m_2}{1 + m_1 m_2}\right|$

(A) 81.9° (B) 79.8° (C) 80.7° (D) 81.2° (E) 82.1°

41. Find the length of the latus rectum of the parabola shown on the right. Stat → Edit $(L_1 = x, L_2 = y)$ $y = 2x^2 - 4x - 2$

(A) $\frac{1}{16}$ (B) $\frac{1}{8}$ (C) $\frac{1}{4}$ (D) $\frac{1}{2}$ (E) 1



Problems 41,42

42. The graph shown on the right is the graph of $y = f'(x)$. If $f(3) = 0$, then $f(-3) =$ _____. $f'(x) = 2x^2 - 4x - 2$

$f(x) = \frac{2}{3}x^3 - 2x^2 - 2x + C$

(A) 0 (B) –18 (C) –22 (D) –24 (E) –30

43. Find the angle between the vectors $v_1 = \langle -3, 2\rangle$ and $v_2 = \langle 5, -11\rangle$. (nearest degree) $\cos\theta = \frac{u \cdot v}{|\vec{u}||\vec{v}|}$

(A) 32° (B) 122° (C) 77° (D) 148° (E) 103°

44. Evaluate $\lim_{\theta \to 0} \frac{\sin(2\theta)}{5\theta}$ $\lim_{\theta\to 0} \frac{\sin 2\theta}{2\theta\left(\frac{5}{2}\right)} = \lim_{\theta\to 0} \frac{2}{5}\left(\frac{\sin 2\theta}{2\theta}\right) = \frac{2}{5}\lim_{\theta\to 0}\frac{\sin 2\theta}{2\theta} = \frac{2}{5}(1)$

(A) $\frac{1}{5}$ (B) $\frac{2}{5}$ (C) 1 (D) $\frac{5}{2}$ (E) does not exist

45. Given: $x^2 + y^2 = 64$, find the value of $\frac{d^2x}{dy^2}$ at the point $(2, -2\sqrt{15})$. (nearest hundredth) $x^2 + y^2 = R^2$

$2x\frac{dx}{dy} + 2y = 0$ $\frac{dx}{dy} = -\frac{y}{x}$ $\frac{d^2x}{dy^2} = \frac{d}{dy}\left(-\frac{y}{x}\right) = \frac{-1(x) - (-y)\frac{dx}{dy}}{x^2} = \frac{-x + \left(\frac{y^2}{x}\right)}{x^2} = \frac{-x}{x^2} - \frac{y^2}{x^3} = \frac{-(x^2+y^2)}{x^3} = \frac{-R^2}{x^3}$

(A) 0.11 (B) –0.14 (C) 0.14 (D) –0.12 (E) –0.18

46. $\frac{d}{d\theta}\sin\left(3\theta^2\right) =$ _____. $= \cos(3\theta^2)\frac{d}{d\theta}(3\theta^2)$

(A) $-3\cos(6\theta)$ (B) $6\theta\cos\left(3\theta^2\right)$ (C) $\cos(6\theta)$ (D) $3\theta\cos\left(3\theta^2\right)$ (E) $-3\theta\cos\left(3\theta^2\right)$

47-48. Consider the region bounded by the graphs of $y_1 = 0.5x^2 - 3$ and $y_2 = x + 1$.

47. Find the area of the bounded region. (nearest tenth) $\int_{-2}^{4}(y_2 - y_1)\,dx$

(A) 18.0 (B) 16.3 (C) 16.7 (D) 17.2 (E) 17.7

48. Find the volume of the solid generated by revolving the specified region about the line $y = -3$. (nearest whole number) $\pi\int_{-2}^{4}[(y_2-(-3))^2-(y_1-(-3))^2]\,dx$

(A) 115 (B) 82 (C) 259 (D) 362 (E) 278

49. A Ferris wheel is built so that the bottom is at ground level. It has a radius of 10 m is rotating at a rate of one revolution every 2 minutes. When a rider is 18 m above the ground on his way up, he is rising at a rate of _____ m/min.

(A) $20.5\pi$ (B) $16\pi$ (C) $15\pi$ (D) $6\pi$ (E) $8\pi$

50. If $P_4(x)$ is the fourth degree Maclaurin polynomial for $f(x) = \cos x$, then $f\left(\frac{\pi}{3}\right) - P_4\left(\frac{\pi}{3}\right) =$ _____. (nearest ten-thousandth) RADIANS $P_4(x) = 1 - \frac{x^2}{2!} + \frac{x^4}{4!}$

(A) –0.0016 (B) –0.0018 (C) –0.0019 (D) –0.0022 (E) –0.0025

51. When evaluating $\int \frac{x}{\sqrt{1-4x^2}}dx$ using $u$-substitution, the best choice for $u$ is_____. $u = 1-4x^2$, $du = -8x\,dx$, $-\frac{1}{8}\int \frac{1}{\sqrt{u}}\,du$

(A) $\sqrt{1-4x^2}$ (B) $4x^2$ (C) $1-4x^2$ (D) $x$ (E) $x^2$

| Game | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Points | 49 | 55 | 73 | 52 | 68 | 64 | 35 | 47 | 37 | 45 | 27 | 42 | 17 | 52 |

Use the table above for problems 52, 53 and 54. 1-var stats
The table shows the season scores for 2022 5A Football State Champion Team from Aledo.

$\bar{x}$ = mean $\sigma$ = standard deviation

52. What is the difference in the mean score and the median score, a positive number. (nearest tenth)

(A) 1.7 (B) 0.2 (C) 1.3 (D) 1.1 (E) 0.6

53. Find the interquartile range of the scores. $IQR = Q_3 - Q_1$

(A) 20 (B) 18 (C) 11 (D) 7 (E) 56

54. Calculate the standard deviation of the scores for Aledo's 2022 season. (nearest tenth)

(A) 14.8 (B) 15.4 (C) 15.0 (D) 14.9 (E) 15.2

55. Over time, Cyd establishes that her commute times are normally distributed with a mean of 32 minutes and a standard deviation of 6 minutes. What is the probability that on a single day her commute will take longer than 40 minutes? 2nd → vars → normalcdf( lower: $-1E99$ upper: 40

(A) 0.081 (B) 0.171 (C) 0.041 (D) 0.091 $\mu = 32$ $\sigma = 6$ (E) 0.909

1- normalcdf

56. Three cards are dealt from a standard 52-card deck. What is the probability that the first is an ace, the second is a spade, and the third is black?

(A) $\frac{25}{2652}$ (B) $\frac{1}{104}$ (C) $\frac{613}{66300}$ (D) $\frac{469}{66300}$ (E) $\frac{13}{1275}$

57. A fair coin is tossed six times. What is the probability of tossing at least four consecutive heads?

(A) $\frac{11}{32}$ (B) $\frac{3}{32}$ (C) $\frac{11}{21}$ (D) $\frac{15}{64}$ (E) $\frac{1}{8}$

58. Five professional drivers drove a course with speeds of 90 mph, 102 mph, 98 mph, 110 mph and 103 mph. The average speed for all of the trips was _____ mph. (nearest tenth)

(A) 100.6 (B) 100.4 (C) 100.2 (D) 100.0 (E) 100.8

59. In 2022, there were 44 states that had some form of casino gambling, 45 states that sold lottery tickets of some kind, and 43 states that had both casinos and lottery. How many states did not have either?

(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

60. A survey asked a random sample of 800 holiday grocery shoppers whether they would cut their grocery budgets in January. Of the sample, 675 said "yes." Construct a 95% confidence interval for the portion of the city's grocery shoppers who would say "yes." if asked this question. (nearest ten-thousandth)

(A) (.8048,.8813) (B) (.8186,.8689) (C) (.8116,.8758) (D) (.8142,.8693) (E) (.8205,.8536)

57. 4 heads | 5 heads | 6 heads

O O O O

O O O O

O O O O

(6 ways out of $2^6$)

58. $\frac{5}{90^{-1}+102^{-1}+98^{-1}+110^{-1}+103^{-1}}$

59. $A + B = A \cap B + A \cup B$

$44 + 45 = 43 + A \cup B$

$A \cup B = 46$

$50 - 46 = 4$

60. Stat → Tests

1-PropZInt

x: 675

n: 800

C-Level: 0.95