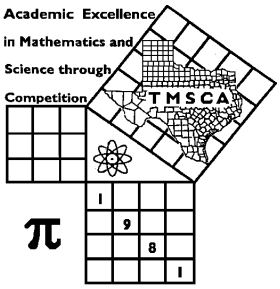


T M S C A H I G H S C H O O L

M A T H E M A T I C S

T E S T # 5 ©

N O V E M B E R 1 0, 2 0 1 2

GENERAL DIRECTIONS

1. About this test:
   A. You will be given 40 minutes to take this test.
   B. There are 60 problems on this test.
2. All answers must be written on the answer sheet/Scantron form/Chatsworth card provided. If you are using an answer sheet, be sure to use **BLOCK CAPITAL LETTERS**. Clean erasures are necessary for accurate grading.
3. If using a scantron answer form, be sure to correctly denote the number of problems not attempted.
4. You may write anywhere on the test itself. You must write only answers on the answer sheet.
5. You may use additional scratch paper provided by the contest director.
6. All problems have **ONE** and **ONLY ONE** correct [BEST] answer. There is a penalty for all incorrect answers.
7. Calculators used on this test must be conform to the UIL standards. Graphing calculators are allowed. Calculators need not be cleared.
8. All problems answered correctly are worth **SIX** points. **TWO** points will be deducted for all problems answered incorrectly. No points will be added or subtracted for problems not answered.
9. In case of ties, percent accuracy will be used as a tie breaker.

2012-2013 TMSCA High School Mathematics

1. What is $22.22...\%$ of $\left(\left(\frac{5}{6}\right)\div 0.0\overline{5}\right)$?

(A) $\frac{10}{3}$ (B) $\frac{5}{1152}$ (C) $\frac{1}{45}$ (D) $\frac{2}{45}$ (E) $\frac{5}{9}$

2. The statement $abc = cab$ is an example of

(A) distributive (B) identity (C) associative (D) inverse (E) commutative

3. Bonnie plans to buy two dozen cupcakes that usually cost \$1.10 each. She receives a 20% discount on the first dozen, a 25% discount on the second dozen, and pays 8.225% sales tax on the total. How much will her order cost?

(A) \$22.14 (B) \$35.00 (C) \$17.95 (D) \$20.46 (E) \$22.71

4. The points $P(7,12)$ and $Q(5,20)$ are on the line $\overleftrightarrow{PQ}$. The equation of the line parallel to $\overleftrightarrow{PQ}$ through the point $(-1,3)$ is:

(A) $4x+y+1=0$ (B) $4x+y-7=0$ (C) $4x-y+5=0$ (D) $x-4y+5=0$ (E) $4x+y-40=0$

5. If $8x^3+36x^2+54x+27=(ax+b)^3$ where $a,b,c\in\mathbb{Z}$, then $a+b=$_____.

(A) 5 (B) 8 (C) 7 (D) 9 (E) 4

6. Find the mean of the median and mode of 3.75, 3.5, 4.25, 2.75, 3.5, 5.25, 4, 5.

(A) 3.9375 (B) 3.75 (C) 3.875 (D) 3.6875 (E) 4

7. Angle A is complementary to angle B and supplementary to angle C. If $m\angle B = 4x-1$ and $m\angle C = 12x+1$. Find the measure of angle A.

(A) 43° (B) 52° (C) 47° (D) 38° (E) 55°

8. Solve for *y*: $2xy+3x-5=y-x$

(A) $\frac{x+5}{2x+4}$ (B) $\frac{x-5}{2x+4}$ (C) $\frac{x-5}{2x+2}$ (D) $\frac{5-4x}{2x-1}$ (E) $\frac{5}{x+4}$

9. Given the sequence -13, -9, 1, 17, …, 361, *k*, 507, find the value of *k*.

(A) 447 (B) 458 (C) 434 (D) 410 (E) 431

10. What is the smallest angle formed by the hour and minute hand on the clock at 11:32?

(A) 116° (B) 154° (C) 136° (D) 236° (E) 224°

11. For a given spring, the extension *x* varies directly with the magnitude of the applied force *F*. If $x = 0.3$ meters when $F = 5$ newtons find *x* when $F = 8$ newtons.

(A) 0.053 meters (B) 0.15 meters (C) 0.1875 meters (D) 0.48 meters (E) 0.5625 meters

12. Abby and Bill can build a brick wall that is 4 feet long and 3 feet high in 6 hours together. How long will it take for them to build a wall twice as long and twice as high if they work at the same pace?

(A) 12 hours (B) 4 hours (C) 6 hours (D) 24 hours (E) 8 hours

13. What is the phase shift of $f(x)=1.3+2.5\cos(3x-8)$?

(A) 1.3 (B) $-\frac{8}{3}$ (C) 5 (D) $\frac{3}{8}$ (E) $\frac{8}{3}$

14. A ship travels 200 km on a bearing of 160° followed by 300 km on a bearing of 200°. Find the final bearing of the ship from its original position.

(A) 188 (B) 184° (C) 180° (D) 182° (E) 186°

15. Given $f(x)=7x^4+11x^3-5x^2+20x-9$, find the sum of the coefficients of the linear and quadratic terms of $f'(x)$.

(A) 23 (B) 7 (C) 28 (D) 6 (E) 13

16. If the area of a regular heptagon is 48 cm^2 what is the length of the apothem?

(A) 6.55 (B) 4.19 cm (C) 1.82 cm (D) 3.77 (E) 3.63 cm

17. How many solutions exist to the equation $7x+5y=116$ such that *x* and *y* are both non-negative integers?

(A) 4 (B) 3 (C) 11 (D) 5 (E) 0

18. Simplify: $\left(-2-3\sqrt{-10}\right)\left(4\sqrt{-8}\right)$.

(A) $112\sqrt{10}$ (B) $48\sqrt{5}-16i\sqrt{2}$ (C) $80\sqrt{10}$ (D) $80\sqrt{3}$ (E) $48\sqrt{5}+16i\sqrt{2}$

19. A particle's movement along the number line is defined by the function $f(t)=t^4-4t^3-26t^2+60t+25$. At which of the following times is the particle moving to the right?

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

20. If four letters are chosen at random from the word **SPHERICAL**, what are the odds that the selection will not contain any vowels?

(A) 37:5 (B) 5:42 (C) 2:5 (D) 5:37 (E) 42:5

21. A rectangle is bounded by the *x*-axis and the curve $y=\sqrt{36-x^2}$. What is the maximum area possible for the rectangle?

(A) 12 u^2 (B) $3\sqrt{2}$ u^2 (C) 24 u^2 (D) $6\sqrt{2}$ u^2 (E) 36 u^2

22. A baseball diamond has the shape of a square with sides 90 ft long. A player runs from first base to second base at a rate of 28 ft/sec. How fast is the player's distance from home plate changing when the player is 20 ft from second base?

(A) 6.07 ft/sec (B) 24.69 ft/sec (C) 18.52 ft/sec (D) 12.35 ft/sec (E) 17.19 ft/sec

23. The one leg and the hypotenuse of a right triangle have lengths of 0.9*x* cm and 1.5*x* cm respectively. What is the area of the triangle in terms of *x*?

(A) $1.35x^2$ cm^2 (B) $1.08x^2$ cm^2 (C) $0.675x^2$ cm^2 (D) $0.54x^2$ cm^2 (E) $0.81x^2$ cm^2

24. The ellipse $4x^2+y^2-8x+4y-8=0$ has foci at (x_1,y_1) and (x_2,y_2). Find the value of y_1+y_2.

(A) $-2-4\sqrt{3}$ (B) 2 (C) -4 (D) $-2+4\sqrt{3}$ (E) $-4+4\sqrt{3}$

25. Find the value of *k* in the sequence: 1, 4, 5, 9, …, *k*, 1076.

(A) 665 (B) 411 (C) 1075 (D) 871 (E) 768

26. Given $f(x)=2x+5$ and $g(x)=x^3-1$, find $g(f(x))$.

(A) $8x^3+10x^2+50x+125$ (B) $8x^3+20x^2+50x+124$ (C) $8x^3+125$ (D) $8x^3+60x^2+150x+124$ (E) $8x^3+124$

27. Find the lateral surface area of a right square pyramid if the diagonal of the base and the height of the pyramid both have lengths of 14 cm.

(A) $49\sqrt{3}$ cm^2 (B) $98\sqrt{3}$ cm^2 (C) 294 cm^2 (D) $196\sqrt{3}$ cm^2 (E) $98\sqrt{6}$ cm^2

28. The intersection of the ____of a triangle is the center of the circumscribed circle.

(A) medians (B) angle bisectors (C) midpoints (D) perpendicular bisectors (E) altitudes

29. Find $\frac{d}{dx}\left(\frac{x^2-6x+9}{x^2-9}\right)$.

(A) $-\frac{6}{x^2+6x-9}$ (B) $\frac{6}{x^2+6x-9}$ (C) $\frac{2x-6}{2x}$ (D) $\frac{6}{x^2+6x+9}$ (E) $\frac{6}{x^2-6x-9}$

30. On one roll of three independent, fair tetrahedral die, what is the probability that the sum of the three dice is less than 5?

(A) $\frac{1}{16}$ (B) $\frac{1}{6}$ (C) $\frac{2}{3}$ (D) $\frac{1}{8}$ (E) $\frac{1}{7}$

31. If an integral factor of 96, not including 1 or 96 is chosen at random, what are the odds that it is a multiple of 3?

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

32. Using the array on the right, determine the value of the mean of the 12th row.

(A) $\frac{256}{3}$ (B) $\frac{1024}{3}$ (C) $\frac{1024}{13}$ (D) $\frac{4096}{11}$ (E) $\frac{512}{3}$

2
2 2
2 4 2
2 6 6 2

33. $M(-1,-7)$ is the midpoint of $\overline{AB}$. Given the coordinates $A(4,2)$ and $B(x_1, y_1)$, and the fact that *B* is on the line $4x+7y=-136$ find the coordinates of *B*.

(A) $(-5,-14)$ (B) $(-4,-14)$ (C) $(-6,-15)$ (D) $(-6,-16)$ (E) $(-5,-15)$

34. An airplane flying into a headwind travels 1800 miles in 3 hours and 36 minutes. The return flight takes 3 hours. Find the airspeed of the plane if the airspeed of the plane and the speed of the wind are constant throughout.

(A) 100 mph (B) 50 mph (C) 550 mph (D) 500 mph (E) 1100

35. Evaluate: $\sum_{n=1}^{\infty}\frac{2}{3}\left(\frac{1}{5}\right)^n$.

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

36. A continuous random variable X has probability density function $f(x)=\begin{cases}k\left(2x-x^2\right), 0\le x\le 2\\ 0, elsewhere\end{cases}$. Find the value of *k*.

(A) 0.75 (B) $1.\overline{3}$ (C) 1.25 (D) 0.8 (E) $1.\overline{3}$

37. A spherical balloon is inflated so that the surface area is changing at a rate of 200 square centimeters per minute. How fast is the area of a great circle on the balloon changing when the radius is 60 centimeters?

(A) $0.8\overline{3}$ cm^2/min (B) 50 cm^2/min (C) 100 cm^2/min (D) 1.2 cm^2/min (E) 75 cm^2/min

38. Let *A* and *B* be the roots of $3x^2-4x-7=0$. Find the value of $A^4+4A^3B+6A^2B^2+4AB^3+B^4$.

(A) $\frac{10000}{81}$ (B) $\frac{256}{81}$ (C) $\frac{10000}{2401}$ (D) $\frac{256}{81}$ (E) $\frac{256}{2401}$

39. Evaluate $1-\frac{(x-1)^2}{2!}+\frac{(x-1)^4}{4!}-\frac{(x-1)^6}{6!}+\ldots$ when $x=3$.

(A) 0.909 (B) -0.416 (C) 0.693 (D) -0.422 (E) 0.933

40. On Triangle ABC, $AB = 18$, $BC = 7$ and $m\angle A = 20^\circ$. Which of the following is one of the two possible lengths of $\overline{AC}$ to the nearest hundredth of a unit?

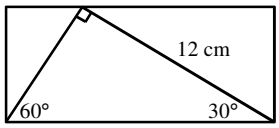
(A) 20.71 (B) 13.58 (C) 16.58 (D) 23.25 (E) 12.13

41. Karen withdrew money from the bank. She spent \$10 on lunch, used three-fourths of the remaining to pay her phone bill, spent half of what was left on groceries and was left with \$10. How much money did she withdraw?

(A) 90 (B) 72 (C) 60 (D) 68 (E) 80

42. Find the area of the rectangle shown.

(A) 36 cm^2 (B) 24 cm^2 (C) $48\sqrt{3}$ cm^2 (D) 72 cm^2 (E) $36\sqrt{3}$ cm^2



43. Which of the following functions expresses the perimeter, *P*, of an equilateral triangle in terms of the length of the apothem, *a*?

(A) $P = 6a\sqrt{3}$ (B) $P = 12a$ (C) $P = 3a\sqrt{3}$ (D) $P = 6a\sqrt{2}$ (E) $P = 12\sqrt{3}$

44. A waiter received a 15% tip from table one in the amount of \$9.00 and a 25% tip from table two in the amount of \$2.50. What was the difference in the bills from table one and two not including the tip?

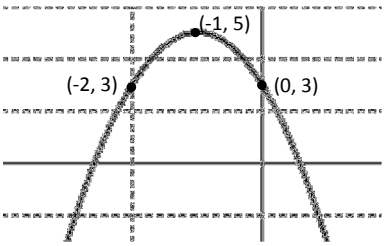
(A) \$8.45 (B) \$60.00 (C) \$50.00 (D) \$5.83 (E) \$7.23

45. A chord of a circle has a length of 24 in and is 5 in from the center of the circle. Find the area of the circle?

(A) 75.39 in^2 (B) 452.39 in^2 (C) 78.54 in^2 (D) 530.93 in^2 (E) 81.68 in^2

46. Find the sum of the roots of the parabola shown on the right.

(A) 8 (B) 2 (C) -4 (D) 4 (E) -2



47. A curve has equation $xy^3 + 2x^2y = 3$. Find the slope of the tangent to this curve at the point (1, 1)

(A) -1 (B) -5 (C) 2 (D) 5 (E) 1

48. Given a sequence with Fibonacci characteristics *a*, 9, *b*, 24, find the value of $a + b$.

(A) 15 (B) 21 (C) 14 (D) 6 (E) 18

49. What is the sum of the coefficients of the cubic and linear terms in the expansion of $(2x+3)^7$?

(A) 42 (B) 30618 (C) 32886 (D) 2106 (E) 1542

50. Given that $(x-2)$ and $(x+2)$ are factors of $f(x) = x^3 + px^2 + qx + 4$, find the value of $p + q$.

(A) -1 (B) 4 (C) -5 (D) -4 (E) 5

51. A desk has three drawers. Drawer 1 contains three gold coins. Drawer 2 contains two gold coins and one silver coin and Drawer 3 contains one gold coin and two silver coins. A drawer is chosen at random and from it a coin is chosen at random. Find the probability that the chosen coin is gold.

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{2}{3}$ (D) $\frac{5}{6}$ (E) $\frac{5}{9}$

52. The length of a rectangular picture is three times the width. The picture is surrounded by a frame which is 4 inches wide. If the perimeter of the outside of the frame is 96 inches, what is the length of the picture in inches?

(A) 48 in (B) 24 in (C) 8 in (D) 16 in (E) 36 in

53. The reaction times of human beings are normally distributed with a mean of 0.76 seconds and a standard deviation of 0.06 seconds. What is the probability that the reaction time of a person chosen at random will be greater than 0.67 seconds?

(A) 0.067 (B) 0.433 (C) 1 (D) 0.933 (E) 0.567

54. Simplify $a^4 \times b^3 \div a^{-1} \times b^{-4} \times a^2 \div b^2 \div b^{-3}$.

(A) $\dfrac{a^5}{b^2}$ (B) $a^5 b^2$ (C) $a^7 b$ (D) a^7 (E) a^5

55. Given $A = \begin{bmatrix} 3 & 2 \\ 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & -2 \\ 1 & -2 \end{bmatrix}$, find AB.

(A) $\begin{bmatrix} -3 & -4 \\ 2 & -2 \end{bmatrix}$ (B) $\begin{bmatrix} -7 & 7 \\ -4 & 4 \end{bmatrix}$ (C) $\begin{bmatrix} -6 & -24 \\ -2 & -8 \end{bmatrix}$ (D) $\begin{bmatrix} -7 & -4 \\ 7 & 4 \end{bmatrix}$ (E) $\begin{bmatrix} -1 & -10 \\ -1 & -6 \end{bmatrix}$

56. Simplify $\dfrac{(x+2)!}{(x-3)!} \div \dfrac{(x+1)!}{(x-1)!}$.

(A) $x^3 - x^2 - 4x + 4$ (B) $\dfrac{x+2}{x^2 - 3x + 2}$ (C) $x^4 - x^3 + 2x^2 + 4x$ (D) $\dfrac{x^4 - 5x^2 + 4}{x^2}$ (E) $x^4 - 5x^2 + 4$

57. $\tan x + \cot x =$

(A) $\cos x \cot x$ (B) $\sin x \tan x$ (C) $\sec x \tan x$ (D) $\sin x \cos x$ (E) $\sec x \csc x$

58. On triangle ABC the points M and K are the midpoints of sides $\overline{AB}$ and $\overline{CB}$ respectively. If the area of triangle BMK is 14 in^2, find the area of the trapezoid $AMCK$.

(A) 21 in^2 (B) 56 in^2 (C) 28 in^2 (D) 42 in^2 (E) 35 in^2

59. How many positive perfect cubes are factors of $(3!)(5!)(6!)$?

(A) 3 (B) 5 (C) 4 (D) 8 (E) 6

60. Let $a = \log x$, $b = \log y$ and $c = \log z$. Write $\log\left(\dfrac{x^2\sqrt{y^3}}{z^3}\right)$ in terms of a, b, and c.

(A) $\dfrac{3ab}{2} - 3c$ (B) $\dfrac{a^2\sqrt{b^3}}{c^3}$ (C) $\dfrac{-3ab}{2c}$ (D) $a^2 + \sqrt{b^3} - c^3$ (E) $2a + \dfrac{3}{2}b - 3c$

2012-2013 TMSCA High School Mathematics Test 5 Key

1. A	21. E	41. A
2. E	22. E	42. C
3. A	23. D	43. A
4. A	24. C	44. C
5. A	25. A	45. D
6. D	26. D	46. E
7. C	27. C	47. A
8. D	28. D	48. B
9. E	29. D	49. C
10. B	30. A	50. C
11. D	31. E	51. C
12. D	32. B	52. B
13. E	33. D	53. D
14. B	34. C	54. D
15. A	35. E	55. E
16. D	36. A	56. A
17. B	37. B	57. E
18. B	38. B	58. D
19. E	39. B	59. E
20. D	40. B	60. E

2012 – 2013 TMSCA Solutions Mathematics Test Five

1. $\frac{2}{9}\cdot\left(\frac{5}{6}\cdot 18\right)=\frac{2}{9}\cdot 15=\frac{10}{3}$

2. definition of commutative property

3. $1.1(12)(0.8+0.75)(1.08225)=22.14$

4. $m=-4,\ y-3=-4(x+1)$

   $4x+y+1=0$

5. $a^3=8\to a=2,\ b^3=27\to b=3,$

   $a+b=5$

6. mode = 3.5, med = 3.875,

   $\frac{3.5+3.875}{2}=3.6875$

7. $a+4x-1=90,\ a+12x+1=180$

   solving system yields $x=11,\ a=47$

8. $2xy-y=5-4x,\ y(2x-1)=5-4x$

   $y=\frac{5-4x}{2x-1}$

9. quad reg: $y=3x^2-5x-11,\ k=431$

10. $30\left(11+\frac{32}{60}\right)-6(32)=154^\circ$

11. $x=kF,\ 0.3=5k,\ k=0.06,$

    $x=0.06(8)=0.48$ m

12. $2r(6)=12,\ r=1,\ 2(1)t=48,\ t=24$ hr

13. if $y=a+b\cos(cx-d)$, ps $=\frac{d}{c}=\frac{8}{3}$

14. $x=200\cos(-70)+300\cos(-110)\approx -34.20$

    $y=200\sin(-70)+300\sin(-110)\approx -469.85$

    $\arctan\frac{y}{x}\approx 85.56,$

    bearing $=180+(90-85.83)\approx 184$

15. terms: $33x^2,\ -10x$, sum = 23

16. $48=\frac{7}{2}r^2\sin\left(\frac{360}{7}\right),\ r\approx 4.188$

    $a=r\cos\left(\frac{360}{14}\right)\approx 3.77$

17. $y=\frac{(116-7x)}{5}$, use table

18. $\left(-2-3i\sqrt{10}\right)\left(8i\sqrt{2}\right)=-16i\sqrt{2}-24i^2\sqrt{20}$

    $=48\sqrt{5}-16i\sqrt{2}$

19. $f'(t)=4t^3-12t^2-52t+60>0$, @ $x=0$

20. $\binom{6}{4}=15$ choices with no vowels

    $\binom{9}{4}=126$ total, odds $=\frac{15}{126-15}=\frac{5}{37}$

21. $A=2x\sqrt{36-x^2}$, graph: max: 36 u^2

22. $a^2+90^2=d^2,\ 2a\frac{da}{dt}=2d\frac{dd}{dt}$

    $2(70)(28)=2\sqrt{13000}\frac{dd}{dt},\ \frac{dd}{dt}\approx 17.19$ ft/s

23. $b=\sqrt{(1.5x)^2-(0.9x)^2}=1.2x$

    $A=\frac{0.9x(1.2x)}{2}=0.54x^2$

24. $4(x^2-2x+1)+(y^2+4y+4)=8+4+4$

    $\frac{(x-1)^2}{4}+\frac{(y+2)^2}{16}-1,\ y_1+y_2=-2(2)=-4$

25. Fibonacci-type sequence, add up 665

26. $(2x+5)^3-1=(2x)^3+3(2x)^2(5)+3(2x)(5)^2+5^3-1$

    $=8x^3+60x^2+150x+124$

27. $l^2=14^2+\left(3.5\sqrt{2}\right)^2,\ l=\frac{21\sqrt{2}}{2},$

    $LSA=4\cdot\frac{1}{2}\left(\frac{21\sqrt{2}}{2}\right)\left(7\sqrt{2}\right)=294$ cm^2

28. definition of perpendicular bisectors

29. $\frac{d}{dx}\left(\frac{x-3}{x+3}\right)=\frac{(x+3)-(x-3)}{x^2+6x+9}=\frac{6}{x^2+6x+9}$

30. 1-way to roll a 3, 3 ways to roll a 4

    $p=\frac{4}{4^3}=\frac{1}{16}$

31. 2, **3**, 4, **6**, 8, **12**, 16, **24**, 32, **48**, odds = 1

32. $\frac{2^{12}}{12}=\frac{1024}{3}$

33. $\frac{x+4}{2}=-1\to x=-6,\ \frac{y+2}{2}=-7\to y=-14$

34. $(3.6)(p-w)=1800,\ (3)(p+w)=1800$

    $p-w=500,\ p+w=600,\ p=550$ mph,

    $w=50$ mph

35. $a=\frac{2}{15},\ S=\frac{2}{15}\div\left(1-\frac{1}{5}\right)=\frac{1}{6}$

36. $\left[k\left(x^2-\frac{x^3}{3}\right)\right]_0^2=1,\ k=0.75$

37. $\frac{dS}{dt}=200=8\pi r\frac{dr}{dt},\ \frac{dA}{dt}=2\pi r\frac{dr}{dt}=50$

38. $\left(\frac{7}{3}-1\right)^4=\frac{256}{81}$

39. $\cos 2\approx -0.416$

40. $7^2=18^2+x^2-2\cdot 18\cos 20$, graph:

    $x\approx 13.58$

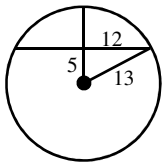
41. $10\cdot 2=20\to 80\to 90$

42. $b=8\sqrt{3},\ h=6,\ A=48\sqrt{3}$

43. $s=2a\sqrt{3}\ \ p=3\left(2a\sqrt{3}\right)=6a\sqrt{3}$

44. $\frac{9}{0.15}-\frac{2.50}{0.25}=50$

45. $A=169\pi\approx 530.92$



46. reg equ: $y=-2x^2-4x+3$, sum of the

    roots $=-\frac{b}{a}=-\frac{-4}{-2}=-2$

    $3xy^2\frac{dy}{dx}+y^3+2x^2\frac{dy}{dx}+4xy=0,$

    $3\frac{dy}{dx}+1+2\frac{dy}{dx}+4=0,\ \frac{dy}{dx}=-1$

48. $9+b=24\to b=15,$

    $a+9=15\to a=6$

    $a+b=21$

49. $\binom{7}{3}(2x)^3(3)^4=22680x^3,$

    $\binom{7}{1}(2x)^1(3)^6=10206x$, sum = 32886

50. $f(2)=0=8+4p+2q+4$

    $f(-2)=0=-8+4p-2q+4$

    $0=8p+8\to p=-1\ ,\ q=-4$, sum = -5

51. $\frac{1}{3}(1)+\frac{1}{3}\left(\frac{2}{3}\right)+\frac{1}{3}\left(\frac{1}{3}\right)=\frac{2}{3}$

52. $2(w+8+3w+8)=96\to w=8,\ l=24$ in

53. $z=\frac{0.67-0.76}{0.06}=-1.5$, use normal

    $p\approx 0.933$

54. $a^4b^3a^1b^{-4}a^2b^{-2}b^3=a^7$

55. $\begin{bmatrix}-3+2 & -6-4\\ -2+1 & -4-2\end{bmatrix}=\begin{bmatrix}-1 & -10\\ -1 & -6\end{bmatrix}$

56. $\frac{(x+2)!(x-1)!}{(x+1)!(x-3)!}=(x+2)(x-2)(x-1)$

    $=x^3-x^2-4x+4$

57. $\frac{\sin x}{\cos x}+\frac{\cos x}{\sin x}=\frac{\sin^2 x+\cos^2 x}{\cos x\sin x}=\sec x\csc x$

58. small triangle $=\frac{1}{4}$ of larger triangle

    trapezoid $4(14)-14=42$ in^2

59. $=2^8\cdot 3^4\cdot 5^2$, factors 1^4, 2^4, 3^4, 4^2, 6^4, 12^4

60. $=2\log x+\frac{3}{2}\log y-3\log z$

    $=2a+\frac{3}{2}b-3c$