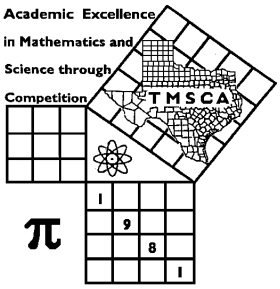

T M S C A H I G H S C H O O L

M A T H E M A T I C S

T E S T # 3 ©

NOVEMBER 3, 2012

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.

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2012-2013 TMSCA High School Mathematics Test 3

1. What is 43.75% of $2.\overline{6} \div 1.4$?
   (A) $\frac{49}{30}$ (B) $\frac{50}{63}$ (C) $\frac{5}{6}$ (D) $\frac{15}{14}$ (E) $\frac{13}{4}$

2. Events A and B are independent such that $P(B) = 3P(A)$ and $P(A \cup B) = \frac{20}{27}$. Find $P(A)$.
   (A) $\frac{2}{9}$ (B) $\frac{2\sqrt{5}}{3}$ (C) $\frac{2}{3}$ (D) $\frac{5}{27}$ (E) $\frac{2\sqrt{5}}{9}$

3. Let x vary inversely with y^2+1. If $x = 20$ when $y = 2$, find x when $y = 7$.
   (A) 70 (B) 2 (C) 4 (D) 200 (E) 100

4. Find the y-intercept of the line containing $(7,3)$ and parallel to $5x - 2y + 6 = 0$.
   (A) $(0,-14.5)$ (B) $(20.5,0)$ (C) $(0,20.5)$ (D) $(5.8,0)$ (E) $(0,14.5)$

5. Given the sequence 2, 2, 9, 16, 35…760, k, 2338, find the value of k.
   (A) 1574 (B) 1347 (C) 1353 (D) 2022 (E) 1512

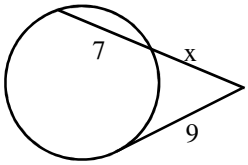
6. If $\int_3^k \frac{1}{x-2}dx = \ln 7$, find the value of k.
   (A) 6.5 (B) 12 (C) 11.5 (D) 9 (E) 23

7. The first term of an infinite geometric sequence is 18, while the third term is 8. The sequence has two possible sums. The larger possible sum is
   (A) 10.8 (B) 32.4 (C) 54 (D) 108 (E) 27

8. Carl has a rope that is two yards, one foot and nine inches long. He cuts it into three pieces in a ratio of 1:2:3. What is the length of the longest piece?
   (A) 2 ft 7 in (B) 1 yd 10.5 in (C) 1 yd 1 ft 9 in (D) 1 ft 3.5 in (E) 1 yd 2 ft 2 in

9. Three brothers can dig a hole 6ft x 3ft x 2ft in one hour. How long would it take four brothers to dig a new hole that is three times as long, wide and deep if they each work at the same rate as the first three?
   (A) 20 hr 25 min (B) 2 hr 25 min (C) 2 hr 15 min (D) 6 hr 45 min (E) 20 hr 15 min

10. Find the value of x on the diagram on the right.
    (A) 1.71 (B) 9 (C) 8 (D) 9.74 (E) 6.16



11. A cylindrical pipe with a diameter of 17 in and a height of 1 yard is filling with water at a rate of 2.7 gal/min. How long will it take to fill?
    (A) 9.68 min (B) 3.08 min (C) 16.68 min (D) 4.37 min (E) 13.10 min

12. Given that $(a+i)(2-bi) = 7-i$, where $a, b \in \mathbb{Z}$, find the value of $a+b$.
    (A) 5.5 (B) -2 (C) 6.5 (D) 4 (E) 2

13. Given the pyramid at right, find the 3rd number in the tenth row.
    (A) 108 (B) 36 (C) 135 (D) 252 (E) 360

```
        3
      3 3
    3 6 3
  3 9 9 3
```

14. If $(2i+3)+(3i-5) \div (1-i) = ai+b$, then $a+b =$
    (A) 0 (B) 10 (C) -1 (D) 11 (E) 9

15. Given $y = \ln(2x-1)$, find the positive value of x for which $\frac{dy}{dx} = \frac{dx}{dy}$.

(A) 1 (B) 2 (C) 0 (D) 0.5 (E) 1.5

16. Given $f(x) = x^3 - 2x^2 - 5x + k$, find k if $(x+2)$ is a factor of $f(x)$.

(A) -10 (B) 6 (C) -26 (D) 10 (E) -6

17. A fair six-sided die with sides labeled 1, 1, 2, 3, 3, 5 is thrown. What is the expected value of a single roll?

(A) 2.75 (B) 2.5 (C) 3 (D) 1.83 (E) 3.25

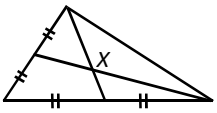
18. Find the total area of the two regions enclosed by the curves $y = x^3 - 3x^2 - 9x + 27$ and $y = x + 3$.

(A) 127.5 (B) 85.75 (C) 106.75 (D) 92.75 (E) 101.75

19. Simplify: $\frac{1}{1-\cos\theta} + \frac{1}{1+\cos\theta}$.

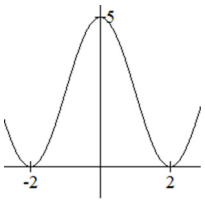
(A) $2\csc^2\theta$ (B) 2 (C) $2\sin\theta$ (D) $2\sec^2\theta$ (E) $2\cos\theta$

20. In the diagram at right, *X* is an example of a/an_____.



(A) centroid (B) circumcenter (C) incenter (D) orthocenter (E) foci

21. If the equation of the function graphed below is $y = a\cos bx + c$, find the value of $a \bullet b \bullet c$.



(A) $\frac{5\pi}{4}$ (B) $\frac{25\pi}{4}$ (C) $-\frac{25\pi}{4}$ (D) $\frac{5\pi}{8}$ (E) $\frac{25\pi}{8}$

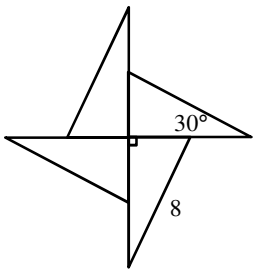
22. Carrie's drives to work every weekday on the highway. Her average daily speeds for the week are 62 mph, 68 mph, 57 mph, 65 mph, and 66 mph. What is her average speed for the week?

(A) 63.36 mph (B) 63.60 mph (C) 63.48 mph (D) 63.72 mph (E) 63.75 mph

23. Corner Doughnuts sells cake, glazed, chocolate cake and chocolate glazed doughnuts. How many distinctly different orders can be placed for a dozen doughnuts?

(A) 455 (B) 1820 (C) 495 (D) 990 (E) 1365

24. The octagon below is made up of four congruent triangles. What is the perimeter of the octagon?

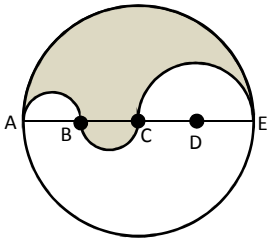


(A) 34.93 (B) 40 (C) 43.71 (D) 48 (E) 38.63

25. $\sum_{n=1}^{8}\left[n(n+1)(n+2)\right] =$

(A) 1572 (B) 1944 (C) 1620 (D) 1656 (E) 1980

26. Given that $\overline{AB} \cong \overline{BC}$, $\overline{AC} \cong \overline{CE}$ and $CE = 6$, find the area of the shaded region.



(A) $\frac{99\pi}{4}$ (B) 18π (C) $\frac{45\pi}{4}$ (D) $\frac{153\pi}{16}$ (E) $\frac{27\pi}{2}$

27. A 16 ft. ladder slides down a wall so that the base of the ladder is moving away from the base of the wall at a rate of 2 inches per second. How fast is the angle between the ladder and ground changing when the angle is $\frac{\pi}{6}$ radians?

(A) $-\frac{\sqrt{3}}{144}$ rad/sec (B) $\frac{1}{48}$ rad/sec (C) $\frac{\sqrt{3}}{144}$ rad/sec (D) $-\frac{1}{48}$ rad/sec (E) $-\frac{1}{96}$ rad/sec

28. If a hiker travels 6 miles on a bearing of 12°, then another 8 miles on a bearing of 334°, what is the shortest distance back to his starting point?

(A) 10.00 miles (B) 2.26 miles (C) 10.06 miles (D) 13.06 miles (E) 13.25 miles

29. Let $a_1 = 12$, $a_2 = 5$, and $a_n = 2a_{n-1} - 3a_{n-2}$. Find a_5.

(A) 147 (B) -56 (C) -339 (D) -159 (E) -33

30. If $f(x) = 2\cos^2 x$, $g(x) = x^2 + 9$, and $h(x) = g(f(x))$, find $h\left(\frac{\pi}{6}\right)$.

(A) 11.25 (B) 9.25 (C) 18.00 (D) 13.91 (E) 5.05

31. What is the surface area of a tetrahedron if the length of one edge is $2\sqrt{2}$ in?

(A) $8\sqrt{2}$ in^2 (B) $4\sqrt{3}$ in^2 (C) $4\sqrt{2}$ in^2 (D) $\frac{8\sqrt{3}}{3}$ in^2 (E) $8\sqrt{3}$ in^2

32. The point $(2,7)$ is reflected over the *x*-axis, reflected over the line $y = x$, rotated 180° clockwise around the origin, then shifted down three units to the point (a,b). Find $a+b$.

(A) 6 (B) 1 (C) 2 (D) -3 (E) 4

33. Which of the following is not a solution to $f(x) \geq \left|\sqrt{x^2} - 9\right|$?

(A) $(-3,5.75)$ (B) $(-8,1)$ (C) $(9,0.25)$ (D) $(0,7.25)$ (E) $(11,2.25)$

34. If $f(x) = x + 7$, $g(x) = 9 - 4x$ and $h(x) = \frac{g(x)}{f(x)}$, find $h^{-1}(1)$.

(A) 5.33 (B) 3.20 (C) -0.67 (D) 0.40 (E) 4.00

35. The mean, median and mode of a set of four numbers are 2, 7.5, and 11 respectively. Find the range of the set.

(A) 11 (B) 29 (C) 5 (D) 25 (E) 4.5

36. If $f(x) = x^3 + ax^2 + bx + c$ and $f(x)$ has zeroes at -5, -2, and 3, find $a+b+c$.

(A) -15 (B) 71 (C) -23 (D) 18 (E) -37

37. Which of the following is closed under addition?

I. natural numbers II. irrational numbers III. negative integers IV. odd integers

(A) I & III (B) I, III & IV (C) II (D) II & IV (E) none of these

38. What is the equation of a line through $(-7,-2)$ that is normal to $2x + 3y = 9$?

(A) $2x + 3y + 20 = 0$ (B) $3x + 2y + 25 = 0$ (C) $2x + 3y + 8 = 0$ (D) $3x - 2y + 17 = 0$ (E) $3x - 2y + 19 = 0$

39. The school day at Austin Elementary School begins at 8:25 am and ends at 4:15 pm. How many degrees does the hour hand on the clock in the cafeteria move during one school day?
(A) 265° (B) 235° (C) 282° (D) 246° (E) 274°

40. $\int\left(\sin^2 x-\cos^2 x\right)dx =$ _____ $+C$, where C is some arbitrary constant.
(A) $\frac{\sin^3 x}{3}-\frac{\cos^3 x}{3}$ (B) $2\left(\sin x+\cos x\right)$ (C) $-\sin x\cos x$ (D) $-x$ (E) $\frac{\sin 2x}{2}$

41. The average life of a color TV is 8 years with a standard deviation of 1.5 years before it breaks. Suppose that a company guarantees color TVs and will replace a TV that breaks while under guarantee with a new one. How long should the company set the guarantee if they do not want to replace more than 5% of TVs?
(A) 10.9 years (B) 11.0 years (C) 5.5 years (D) 10.5 years (E) 8 years

42. Barbara is assembling a committee of students to help with freshman orientation. Four sophomore girls, 3 sophomore boys, 7 junior girls, 5 junior boys, 5 senior girls and 4 senior boys volunteer. If she wants the committee to include two girls and two boys from each upper grade, how many distinct committees could she form from the volunteers?
(A) 8400 (B) 113400 (C) 64 (D) 16800 (E) 226800

43. A seasoned basketball player makes 40% of her free throws. She shoots free throws 3 times during a Friday game. What are the odds that she makes at least 2 of them?
(A) 0.237 (B) 0.310 (C) 0.543 (D) 0.763 (E) 3.223

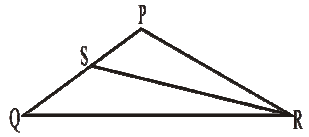
44. Find the digit in the 10^{-8} place of the series: $-3+\frac{3}{2!}-\frac{3}{4!}+\frac{3}{6!}\ldots$.
(A) 1 (B) 6 (C) 9 (D) 5 (E) 8

45. Carla inherited a windfall of x dollars. After putting half into savings, she gave one-third of the remaining money to her sister, forty dollars to her friend, then sixty percent of the remaining to charity. She was left with eighty dollars to spend for fun. What was the amount of the original windfall?
(A) \$520 (B) \$1280 (C) \$720 (D) \$900 (E) \$660

46. How many numbers in the form a^4, where $a\in\mathbb{Z}^+$ divide $3!\times 4!\times 6!$?
(A) 2 (B) 3 (C) 5 (D) 6 (E) none

47. How many possible obtuse triangles are there with two side lengths of 6 and 11 where the length of the third side is an integer?
(A) 3 (B) 7 (C) 4 (D) 8 (E) 11

48. On the diagram shown right, $m\angle Q=35^\circ$, $QR=9$ cm, and $2QS=SR$. Find QS.
(A) 3.29 cm^2 (B) 4.26 cm^2 (C) 7.37 cm^2 (D) 3.69 cm^2 (E) 2.58 cm^2



49. Find the range, or ranges, of values of K can take for $Kx^2-4x+5-K=0$ to have two distinct real roots.
(A) $1<K<4$ (B) $K<1$ and $K>4$ (C) $K<-6$ and $K>2$ (D) $K<\frac{4}{5}$ (E) $-6<K<2$

50. Express $\log\left(10ab^2\right)$ in terms of P and Q if $P=\log a$ and $Q=\log b$.
(A) $10PQ^2$ (B) $10P+2Q$ (C) $10P+Q^2$ (D) $P+2Q$ (E) $P+2Q+1$

51. The sum of the first ten terms of an arithmetic sequence is 120 and the sum of the first twenty terms is 840. Find the sum of the first thirty terms.
(A) 1560 (B) 2250 (C) 2205 (D) 2160 (E) 1910

52. A body moves in a straight line. At time *t* seconds its acceleration is given by $a = 6t + 1$. When $t = 0$, the velocity *v* of the body is 2 m/s and its displacement *s* from the origin is 1 meter. Find an expression for displacement in terms of time.
(A) $3t^2 + t + 2$ (B) $t^3 + \frac{t^2}{2} + 2t + 1$ (C) $6t^2 + t + 2$ (D) $t^3 + t^2 + 4t$ (E) $\frac{t^3}{3} + \frac{t^2}{2} + t + 1$

53. $\left(\sin\theta + \cos\theta\right)^2 + \left(\sin\theta - \cos\theta\right)^2 =$
(A) $\sin^2\theta - \cos^2\theta$ (B) -2 (C) 1 (D) -1 (E) 2

54. The line $3y = x + 5$ forms a chord with the circle $x^2 + y^2 - 6x - 2y - 15 = 0$. Find the length of the chord.
(A) $15\sqrt{10}$ (B) $3\sqrt{10}$ (C) $3\sqrt{5}$ (D) $5\sqrt{2}$ (E) $5\sqrt{3}$

55. An investment is made in a fund that pays an annual percentage rate of 6%, compounded quarterly. How long (to the nearest tenth of a year) will it take for the investment to double?
(A) 11.9 (B) 11.3 (C) 11.6 (D) 11.0 (E) 11.7

56. A department store has two burglar systems, A and B. In the event of an attempted break-in, the systems function properly with probabilities p(A) = 0.95 and p(B) = 0.90. The two systems function independently. When an attempt is made to break in, what is the probability of at least one of the alarm systems functioning properly?
(A) 0.995 (B) 0.885 (C) 0.9925 (D) 0.855 (E) 0.955

57. A company that manufactures dog food wishes to pack food in closed right cylindrical cans. What should the height be if each can is to have a volume of 128π cm^3 and the minimum possible surface area?
(A) 4 cm (B) 16 cm (C) $4\sqrt{2}$ cm (D) $8\sqrt{2}$ cm (E) 8 cm

58. Find $\frac{d}{dx}\left(\frac{2x+1}{x^2-2}\right)$.
(A) $-\frac{2x^2+2x+4}{x^4+4}$ (B) $-\frac{2x^2+2x+4}{x^4-4x^2+4}$ (C) $\frac{2x^2+2x+4}{x^4-4x+4}$ (D) $\frac{1}{x}$ (E) $\frac{2x^2+2x+4}{x^4+4}$

59. $2_3 + 33_4 + 444_5 + 5555_6 =$ _____$_7$
(A) 6034 (B) 4121 (C) 3645 (D) 4323 (E) 1436

60. Random variable *x* is normally distributed such that $P(x > 6.2) = 0.9474$ and $P(x < 9.8) = 0.6368$. Find the mean of the distribution.
(A) 1.83 (B) 8 (C) 9.16 (D) 8.84 (E) 8.12

2012-2013 TMSCA High School Mathematics Test 3 Key

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

2012 – 2013 TMSCA Solutions Mathematics Test Three

1. $\frac{7}{16}\cdot\frac{8}{3}\cdot\frac{5}{7}=\frac{5}{6}$

2. $a+3a-3a^2=\frac{20}{27}$, $81a^2-108a-20=0$

$(9a-2)(9a-10)=0$, $a=\frac{2}{9}$

3. $x=\frac{k}{y^2+1}$. When $20=\frac{k}{2^2+1}$, $k=100$,

$x=\frac{100}{7^2+1}=2$

4. $m=\frac{5}{2}$, $y-3=\frac{5}{2}(x-7)$, $y=14.5$ @

$x=0$

5. rewrite: $1(2)+2(1)+3(3)+4(4)+5(7)...$

Lucas sequence with each term multiplied by the term number….760, **1353**, 23886.

6. $\left[\ln(x-2)\right]_3^k=\ln 7$, $\ln(3k-2)-\ln 1=\ln 7$

$k-2=7$, when $k=9$.

7. $18r^2=8$, $r=\pm\frac{2}{3}$, $S=\frac{18}{1-2/3}=54$

8. $\frac{93in}{1+2+3}=15.5in$, $15.5\cdot 3=46.5$ in

$=1$ yd 10.5 in

9. $3r\cdot 1=36$, $r=12$, $4\cdot 12t=36\cdot 27$,

$t=20.25$ hr $=20$ hr 15 min

10. $81=x(x+7)$ when $x=6.16$

11. $\frac{\pi r^2 h}{231}\approx 35.3735$ gal, $\frac{35.3735}{2.7}\approx 13.10$ min

12. $2a-abi+2i+b=7-i$, $2a+b=7$,

$2-ab=-1$ solve, $a=3$, $b=1$,

$a+b=4$

13. $3\binom{9}{2}=108$

14. $(2i+3)+\frac{(3i-5)}{(1-i)}\cdot\frac{(1+i)}{(1+i)}=(2i+3)+(-4-i)$

$=i-1$ so $a+b=0$

15. $\frac{dy}{dx}=\frac{2}{2x-1}$, $\frac{dy}{dx}=\pm 1$ when $x=-\frac{1}{2},\frac{3}{2}$

16. $f(-2)=-8-8+10+k=0$, $k=6$

17. $1\left(\frac{1}{3}\right)+2\left(\frac{1}{6}\right)+3\left(\frac{1}{3}\right)+5\left(\frac{1}{6}\right)=2.5$

18. $\int_{-3}^{4}\left|x^3-3x^2-9x+27\right|dx=101.75$

19. $\frac{1+\cos\theta+1-\cos\theta}{1-\cos^2\theta}=\frac{2}{\sin^2\theta}=2\csc^2\theta$

20. definition of centroid

21. $a=2.5$, $b=\frac{\pi}{2}$, $c=2.5$, $a\cdot b\cdot c=\frac{25\pi}{8}$

22. $\frac{1}{62}+\frac{1}{68}+\frac{1}{57}+\frac{1}{65}\approx 0.0789$,

$\frac{5}{0.0789}\approx 63.63$ mph

23. $\binom{12+4-1}{12}\approx 455$

24. $4(8)+4\left(4\sqrt{3}-4\right)\approx 43.71$

25. $\sum_{n=1}^{8}\left[n^3+3n^2+2n\right]=$

$\left(\frac{n(n+1)}{2}\right)^2+3\left(\frac{n(n+1)(2n+1)}{6}\right)+2\left(\frac{n(n+1)}{2}\right)$

when $n=8$, sum = 1980

26. $\frac{1}{2}\cdot 6^2\pi-\frac{1}{2}\cdot 3^2\pi=\frac{27\pi}{2}$

27. $\cos\theta=\frac{x}{192}$, $-\sin\theta\frac{d\theta}{dt}=\frac{1}{192}\frac{dx}{dt}$

$-\frac{1}{2}\frac{d\theta}{dt}=\frac{1}{192}2$, when $\theta=\frac{\pi}{6}$, $\frac{d\theta}{dt}=-\frac{1}{48}$

28. $6\cos 12+8\cos 334\approx 13.06$

$6\sin 12+8\sin 334\approx -2.26$,

$\sqrt{13.06^2+(-2.26)^2}\approx 13.25$ miles

29. $a_3=2(5)-3(12)=-26$

$a_4=2(-26)-3(5)=-67$

$a_5=2(-67)-3(-26)=-56$

30. $f\left(\frac{\pi}{6}\right)=2\left(\frac{\sqrt{3}}{2}\right)^2=\frac{3}{2}$, $g\left(\frac{3}{2}\right)=\frac{9}{4}+9=11.25$

31. $4\left(\frac{\left(2\sqrt{2}\right)^2\sqrt{3}}{4}\right)=8\sqrt{3}$

32. $(2,7)\to(2,-7)\to(-7,2)\to(7,-2)\to(7,-5)$

$a+b=2$

33. graph

34. $1=\left(\frac{9-4y}{y+7}\right)\to 5y=2$, so $y=0.4$

35. a, b, 11, 11. $\frac{b+11}{2}=7.5$, so $b=4$

$(a+4+11+11)=4(2)$, so $a=-18$

Range $=11-(-18)=29$

36. product $(x+5)(x+2)(x-3)=$

$x^3+4x^2-11x-30$, $a+b+c=-37$

37. definition of closed

38. $\perp$ $m=1.5$, $y+2=1.5(x+7)$, so

$3x-2y+17=0$

39. $30\left(7+\frac{5}{6}\right)=235$

40. $-\int\cos 2x dx=-\frac{1}{2}\sin 2x+C=-\sin x\cos x+C$

41. z-score = 1.6449, $-1.6449=\frac{x-8}{1.5}$,

$x\approx 5.5$

42. $\binom{4}{2}\binom{3}{2}\binom{7}{2}\binom{5}{2}\binom{5}{2}\binom{4}{2}=226800$

43. $p=3(0.4)^2(0.6)+(0.4)^3=0.352$

odds $=\frac{0.352}{1-0.352}=0.543$

44. $-3\cos 1\approx$ -1.6209069**1**8

45. $80\left(\frac{5}{2}\right)\to 200\to 240\to 360\to 720$

46. $2^8\cdot 3^4\cdot 5$ has factors $1^4,2^4,3^4,4^4,6^4,12^4$.

47. third side of 6, 7, 8, 9, 13, 14, 15 and 16

48. $(2x)^2=x^2+9^2-2\cdot 9x\cos 35$, graph

49. $16-4(K)(5-K)>0$, graph

50. $=\log 10+\log a+2\log b=1+P+2Q$

51. $\frac{10}{2}(2a+9d)=120$, $\frac{20}{2}(2a+19d)=840$

solve system: $a=-15, d=6$,

$S_{30}=15\left(2(-15)+29(6)\right)2160$

52. $v=3t^2+t+2$, $s=t^3+\frac{t^2}{2}+2t+1$

53. let $a=\sin\theta, b=\cos\theta$

$a^2+2ab+b^2+a^2-2ab+b^2$

$=a^2+b^2+a^2+b^2=1+1=2$

54. if $x=3y-5$, substitute to get

$(3y-5)^2+y^2-6(3y-5)-2y-15=0$

$y=1,4$, so intersection points are

$(1,-2)$ and $(4,7)$, $d=\sqrt{3^2+9^2}=3\sqrt{10}$

55. $V=\left(1+\frac{0.06}{4}\right)^{4t}$, graph and intersection with the line $y=2$ at $x=11.6$

56. $p=(0.95)+(0.9)-(0.95)(0.9)=0.995$

57. $128\pi=\pi r^2 h$, $h=\frac{128}{r^2}$,

$SA=2\pi\left(r^2+r\left(\frac{128}{r^2}\right)\right)$, graph

max when $r=4$, $h=8$

58. $f'(x)=\frac{2(x^2-2)-2x(2x+1)}{(x^2-2)^2}$

$=\frac{2x^2-4-4x^2-2x}{(x^2-2)^2}$

$=-\frac{2x^2+2x+4}{x^4-4x^2+4}$

59. $=1436_{10}=4(343)+1(49)+2(7)+1=4121_7$

60. $z_1=-1.6202$, $z_2=0.3499$

$z_1=\frac{6.2-\bar{x}}{\sigma}$ and $z_2=\frac{9.8-\bar{x}}{\sigma}$

solve system: $\bar{x}\approx 9.16$, $\sigma\approx 1.83$