Mathematics Practice Questions

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Practice Test

Multiple Choice Questions

1. The function $f(x) = 2x^2/3 + 2x + 3$ has intercepts at:
    a. (0,3) and (2,0)
    b. (0,3) only
    c. (3,0) and (0,3)
    d. None of the above

2. The set A = {x| $f(x) \geq 2x^2 - 5$} and the set B = {x| $g(x) \leq -x^2 + 4$}. The set C = {x| A ∩ B} has the range:
    a. $-3 < x < 3$
    b. $-3 \leq x \leq 3$
    c. $-\sqrt{3} \leq x \leq \sqrt{3}$
    d. $-\sqrt{3} < x < \sqrt{3}$

3. A round cylinder is 10 cm in diameter and 25 cm in length. It has a total surface area of:
    a. pr2h
    b. 2pr(h + r)
    c. 2pdh
    d. $2pr^2 + h$

4. A triangular prism has a right triangle cross-section. The orthogonal sides are each 2 cm wide, and the total length of the prism is 10 cm. The total surface area of the prism and its volume are:
    a. $(44 + 10\sqrt{2})$ cm^2 and 20 cm^3
    b. $(64\sqrt{2})$ cm^2 and 20 cm^3
    c. 42 cm^2 and 22 cm^3
    d. $2(22 + 10\sqrt{2})$ cm^2 and 20 cm^3

5. A = {0, 1, 2, 4, 8, 9, 16}, B = {1, 3, 5, 7, 9, 11} and C = {0.25a, b/3}

When a = 4 and b = 9, D = A ∩ (B ∩ C) is:
    a. D = {0, 1}
    b. D = {1}
    c. D = {1, 3}
    d. D = {0.25, 8}

6. There are three branches in a particular electrical circuit. An indicator light is on (True) if both the first and third branches are active (True) or if the second and third branches are active (True), but not (False) if both the first and second branches are active. The truth table for the indicator light is

a.

1	T	T	T	T	F	F	F	F
2	T	T	T	T	F	F	T	T
3	F	T	F	T	F	T	F	T
Light	F	T	F	F	F	F	F	T

b.

1	T	T	T	T	F	F	T	T
2	F	T	T	T	F	F	F	F
3	F	T	F	T	F	T	F	F
Light	F	T	F	F	T	F	F	F

c.

1	TT	TT	TT	TT	TF	FT	FF	FF
2	FF	FF	TT	TT	FF	FT	TT	TT
3	FF	TT	FF	TT	FF	TT	FF	TT
Light	TT	TT	FF	FF	FF	TF	FF	TT

d.

1	T	T	T	T	F	F	F	F
2	F	F	T	T	F	F	T	T
3	F	T	F	T	F	T	F	T
Light	F	T	F	F	F	F	F	T

7. The graph of the function $y = 3x^2 - 6x + 18$ has a maximum or minimum value at:
    a. (1, 15)
    b. (3, -6)
    c. (6, -3)
    d. (6, 18)

8. The equation $x^2 - 2x + 3$ has roots:
    a. -2, 3
    b. $1 + i\sqrt{2}, 1 - i\sqrt{2}$
    c. $2 + i\sqrt{3}, 2 - i\sqrt{3}$
    d. $6 - i\sqrt{2}, 6 + i\sqrt{2}$

9. The vectors A and B begin at the origins and extend to the coordinates (6, 16) and (16, 6) respectively. The value of A●B is:

    a. 96
    b. 36
    c. 192
    d. 256

Over a total of 212 test results, the following results were found:

Range	# of tests
0 – 10	1
11 – 20	1
21 – 30	10
31 – 40	13
41 – 50	17
51 – 60	26
61 – 70	72
71 – 80	31
81 – 90	27
91 – 100	14

10. The mean, median and mode ranges of the test scores are:

    a. 58.92 – 68.92, 61 – 70, 61 - 70
    b. 61 – 70, 51 – 60, 61 - 70
    c. 60 – 65, 61 – 70, 61 – 70
    d. 58.92 – 68.92, 61 – 70, 51 - 60

11. Two complex numbers a + ib and c + id are identical

    a. If a and b are equal
    b. If and only if c and d are equal
    c. If and only if a = c and b = d
    d. If and only if a = b and c = d

12. The set A = {0, 2, 4, 6, 8} and the set B = {1, 3, 5, 7}. Which of the following is not a member of the set A X B?

    a. (4,3)
    b. (1,2)
    c. (2,1)
    d. (6,1)

13. The number of elements in the set A = 1,232, in set B = 4,376 and in set C = 3,128. Some elements of A are also found in B and C, and some are found in all of A, B and C. The number of unique, or unshared, elements in the set A U B U C is

    a. 8,736
    b. nA + nB + nC – n(A ∩ B) – n(A ∩ C) – n(B ∩ C)
    c. nA + nB + nC – n(A ∩ B) – n(A ∩ C) – n(B ∩ C). – n(A ∩ B ∩ C)
    d. nA + nB + nC – n(A ∩ B) – n(A ∩ C) – n(B ∩ C). + n(A ∩ B ∩ C)

14. In a group of 48 people, 1/3 claimed to be Christians, 3/16 were followers of Islam, 1/16 were Buddhists, 1/16 were Hindu, 1/48 were Sikh, 1/12 were traditional Native Americans and the remainder claimed no religious affiliation. The number of individuals in each group was:
    a. 12, 4, 1, 3, 3, 9, 16
    b. 16, 9, 3, 3, 1, 4, 12
    c. 12, 1, 4, 3, 3, 9, 16
    d. None of the above

15. A magician has a hat that holds two rabbits. One rabbit is black and the other is white. In his last 16 performances he has randomly pulled the black rabbit from the hat 16 times. The probability that he will pull the white rabbit from the hat in his next performance is:
    a. 0.50
    b. 1
    c. 1/17
    d. 0

16. A bag contains 16 coins, each with a different date. The number of possible combinations of three coins from the bag is:
    a. 650
    b. 48
    c. 560
    d. 6

17 Ten sample values were found to be 6, 7, 7, 9, 5, 7, 8, 2, 6 and 3. The mean and median values of these samples are:
    a. 6 and 6.5
    b. 6 and 7
    c. 6 and 8
    d. 6.5 and 7

18. Seven samples were obtained having the values 21, 22, 26, 29, 27, 26 and 24. The mean and standard deviation values are:
    a. 22.4 and 2.6
    b. 25 and 2.2
    c. 25 and 2.6
    d. 25.6 and 2.2

19. The factors $(x – 3)$, $(x – 4)$ and $(x + 7)$ expand to give the equation:
    a. $x3 – 12x^2 -7x + 84$
    b. $x^3 + 84x^2 – 14x + 14$
    c. $x^3 – 37x + 84$
    d. $x^3 +14x^2 – 7x + 84$

20. When multiplied together the two complex numbers $(6 + i5)$ and $(3 – i3)$ yield:
    a. $(18 - i15)$
    b. $(33 – i3)$
   c. $(33 - i9)$
    d. $(33 - i15)$

21. Given that the value of x is between 0 and 5, but not equal to either 0 or 5, which statement is true?
    a. $0 \leq x^2 \leq 5$
    b. $0 < x^2 < 25$
    c. $0 \leq x^2 \leq 25$
    d. $x^2 \leq 25$

22. A complex right triangle has orthogonal sides of length $(6 + i3)$ and $(4 + i\sqrt{3})$. The hypotenuse has the length:
    a. $\sqrt{(40 + 4i(9 + 2\sqrt{3}))}$
    b. $\sqrt{(40 + i(36 + 2\sqrt{3}))}$
    c. $(40 + 4i(9 + 2\sqrt{3}))$
    d. $(40 + i(36 + 2\sqrt{3}))$

23. A large L-shaped field is 400 m long in its longest side, and 150 m wide at its widest point. The opposite parallel sides are only 1/5 as long. The total perimeter of the field is:
    a. 6000 m
    b. 900 m
    c. 1200 m
    d. 1100 m

24. The total perimeter of an L-shaped field is 800 feet. The longest side is 300 feet, and the longest width is 100 feet. The shorter sides are 50 feet and 50 feet respectively. The total area of the field is:
    a. 22,500 square feet
    b. 30,000 square feet
    c. 17,500 square feet
    d. 45,000 square feet

25. If $2^n = 6$ and $2^8 = 256$, then $2^8 \times 2^n =$
    a. 262
    b. 2^{n+8}
    c. 2^{8n}
    d. $2^n + 6$

26. The series sum of $1/n$ for integer values of n such that $1 \leq n \leq 6$ is:
    a. 2 1/2
    b. 2 9/20
    c. 2 5/6
    d. 2 3/20

27. A certain special die has eight sides instead of six. The probability of rolling an odd number is:
    a. The same as for a six-sided die
    b. One-third more than for a six-sided die
    c. One-third less than for a six-sided die
    d. 25% greater

28. The series sum of (n + 1/n) for integer values 1 ≤ n ≤ 4 is:
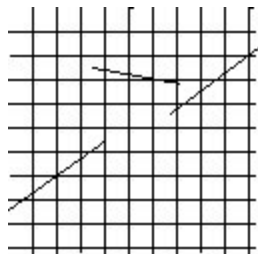   a. 11
    b. A rational real number
    c. A complex number
    d. An integer

29. A certain property has the linear value corresponding to d = (5t – 3) for t ≤ -2, to the quadratic relationship d = t² – t + 3 for -2 ≤ t < +2, and to the linear value d = (5t/3 – 6) for t ≥ +2. A graph of its behavior is:
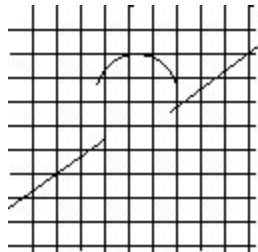
a.
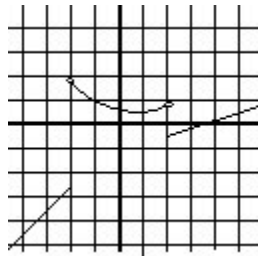
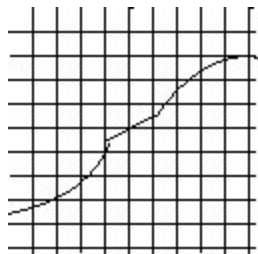

b.

c.
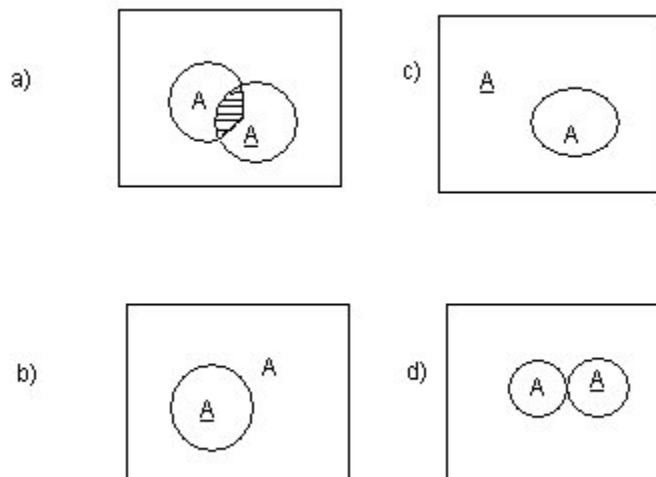

d.

30. The probability that an event A will not occur, 1-A, is represented in a Venn diagram as:

31. If x is greater than five then y equals six and if x is less than two then y equals three can be represented as:
    a. y = 3 for x < 2 and y = 6 for x > 5
    b. 2 ≤ x ≤ 5
    c. 2 > x < 5
    d. xy/2 = 5y/6

32. The value of 7! Divided by 3! is:
   a. 2.33
    b. 840
    c. 210
    d. 1320

33. The equation $2x^2 – 6x + 2 = 0$ has:
    a. Integer roots
    b. No real roots
    c. Real, irrational roots
    d. Complex fractional roots

34. Tomas held out both hands, clearly showing ten digits – eight fingers and two thumbs – and proclaimed "I actually have nine fingers!" His friend Jerzy replied "No, you only have eight fingers!". To prove that he had nine fingers Tomas counted backward on one hand "8 – 7 – 6 – 5", then said "and 4 on this hand makes 9 fingers". This logic is incorrect because:
    a. Tomas counted his thumb as one of the fingers
    b. Tomas was mixing ordinal and cardinal numbers
    c. Tomas began counting from the left instead of the right
    d. Tomas began counting from the right instead of the left

35. The sum of two prime numbers is:
    a. Always odd
    b. Always a prime number
    c. Always even
    d. None of the above

36. $(x - 6)$ is a factor of the equation $2x^3 + 4x^2 - 82x - 84 = 0$. The remainder:

    a. Negative integral roots
    b. Negative complex roots
    c. Negative irrational roots
    d. Both positive and negative roots

37. The graph of $x^2/2 + y^2/5 = 25$ intersects the line $y = 2x + 3$ at coordinates:
    a. (0.4, 2) and (0.2, 3)
    b. (3.40, 9.80) and (-5.25, -7.5)
    c. (2, 0.4) and (3, 0.2)
    d. (3.40, -9.80) and (5.25, -7.5)

38. A equation of a hyperbola has the form:
    a. $yx = a$
    b. $y = ax^2 + b$
    c. $x^2 - y^2 = a$
    d. $x^2 + y^2 = a$

39. "Robert has black hair and Sally does not" is the opposite of:
    a. Robert does not have black hair and Sally does
    b. Robert has light hair but not Sally
    c. Robert does not have black hair even though Sally does
    d. Neither Robert nor Sally have black hair

40. The necessary and sufficient condition for a prime number is:
    a. Divisible only by itself and 1
    b. Divisible only by itself
    c. Is not a product of two numbers
    d. Is the product of prime numbers
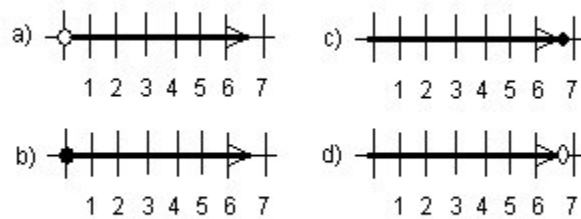
41. The statement 0 < x ≤ 6.5 is represented by the graph above:

42. Two similar triangles A and B are defined by the coordinates A = {(1, 1), (-3, 4), (-4, -6)}, and by B = {(1, 6), (-3, 9), (-4, -1)}. Triangle B can be generated from triangle A by:
    a. Reflection
    b. Adding 5 to the coordinates
    c. Translation
    d. Rotation

43. A circular gazebo is to have a two-foot strip of decorative grillwork hanging down around the top edge. The gazebo is 30 feet in diameter, and the grillwork is available in 4-foot x 8-foot sheets, which can be molded or bent to accommodate the curvature of the gazebo. How many sheets are required?
    a. 5.8875
    b. 6
    c. 12
    d. 11.75

44. Two circular rollers have diameters of 10 cm and 16 cm respectively. The turning rate of the larger roller is controlled by the turning rate of the smaller roller. When the smaller roller has completed 10 rotations, the larger roller will have completed:
    a. 1.6 rotations
    b. 6.25 rotations
    c. 0.625 rotations
    d. 5/8 rotations

45. The opposite of "A or B" is:
    a. Not A or not B
    b. A and not B
    c. Not (A or B.
    d. Not A and B

46. The ratio of 10 to 17.5 is:
    a. 1.75
    b. Real, rational
    c. 2/3.5
    d. b. and c. are true

47. Factors of the equation $x^4 - x^3 - x^2 + 7x - 6 = 0$ include:
    a. $(x + 6)$
    b. $(x - 3)$
    c. $(x - 1)$
    d. $(x - 2)$

48. Rational numbers are always:
    a. Integers
    b. Fractions
    c. Of finite value
    d. Evenly divisible by 2

49. The domain and range of the function $x^2 + y^2 = 49$ are:
    a. $-7 \leq x \leq +7$, and 49
    b. $-7 \leq x \leq +7$
    c. -7, +7 and 49
    d. none of the above

50. The reflection of the function $y = 3x^2 + 6$ about the x-axis is:
    a. $-y = 3x^2 - 6$
    b. $y = -3x^2 - 6$
    c. $y = 3x^{-2} + 6$
    d. $y = 2x^3 + 6$

51. The graph of $y = 1/x$ is:
    a. A straight line of decreasing slope
    b. A straight line of positive slope
    c. A hyperbolic curve in the (+x, -y) quadrant
    d. Asymptotic to the x and y axes

52. The graph of $x = 1/y$ is:
    a. Symmetric about the line $y = x$
    b. A straight line with negative slope
    c. A straight line with increasing slope
    d. A parabolic curve

53. The function $y = \sin(x)$ is a cyclical function whose values repeat on a period of:
    a. 90o
    b. p radians
    c. 2p radians
    d. (p/2) radians

54. The graph of the function $y = 1/x^2$ is:
    a. Discontinuous
    b. Asymptotic to the +y axis
    c. Undefined for $x = 0$
    d. All of the above

55. Six different objects can be arranged in
    a. 6! ways
    b. 36 ways
   c. 360 ways
    d. 12 ways

56. In an experimental sample of 475 people, 92 conformed to one specific criterion. They can be represented in a pie chart by a sector spanning
    a. 92°
    b. (360 / 475)°
    c. (92 / 360)°
    d. 70°

57. If the probability of a particular event occurring is 0.25, the *odds* against it are
    a. 3 to 1
    b. 0.75
    c. 25 to 1
    d. 75%

58. In a series of 10-point ranges from 0 – 100, 6 results were in the lowest range, 12 in the second, 17 in the third, 33 in the fourth, 57 in the fifth, 67 in the sixth, 52 in the seventh, 26 in the eighth, 12
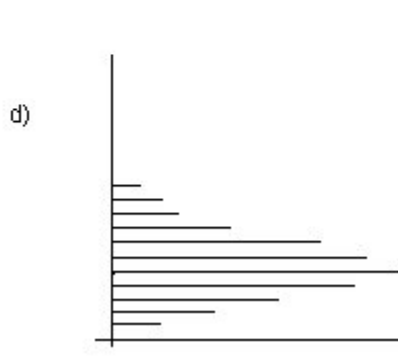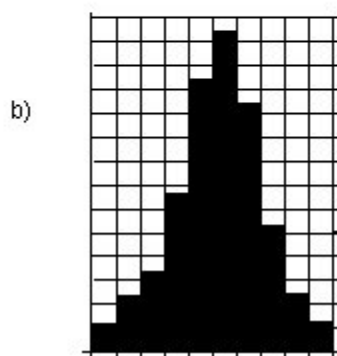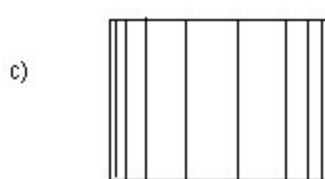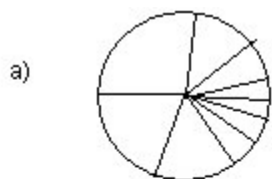
in the ninth and 6 in the tenth. This is illustrated in:

59. An eight-sided die shows the numbers 1 through 7 and a red spot. The probability of the red spot appearing on three consecutive rolls of the die is:
    a. 1/64
    b. 1/8
    c. 1/8 x 1/8 x 1/8
    d. 1:64

60. Given that 25% of police cars are black, the probability that the black car in the rear-view mirror is a police car is:

    a. 0.25
    b. 0.75
    c. Unknown
    d. 3/16

Answer Key

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

Answers and Explanations

1. B: The y-intercept at x = 0 has the value f(x) = +3. For an x-intercept, the value of f(x) must be 0 for some real value of x, but f(x) in this case never has a value less than +3.

2. C: The set C corresponds to the values of x for which the area above the curve defined by f(x) is coincident with the area below the curve defined by g(x). This area contains all values bounded by the condition that f(x) = g(x), which in this case is true only at x = -√3 and x = +√3.

3. B: The total surface area of the cylinder is the sum of the two circular ends plus the outer surface of the body. The outer body can be represented as a plane rectangle of which two opposite sides meet at the same line, with the dimensions of the length and the circumference of the cylinder. The circumference is 2pr and the length is h. The area of each end of the cylinder is the area of a circle, pr2, and there are two ends, so the total area of the ends is 2pr2. The total surface area of the cylinder is therefore 2prh + 2pr2, or 2pr(h + r).

4. D: The cross-section of the prism is a right triangle with orthogonal sides of 2 cm. The hypotenuse side is, by Pythagorean Theorem, √8 or 2√2 cm. The surface area of the two ends is calculated as 2(1/2 bh), or 4 cm2. The surface area of the two orthogonal sides of the prism is 2 (2 X 10) cm, or40 cm2. The surface of the angle face of the prism is 2√2 X 10, or 20√2 cm2. Altogether the total surface area of the prism is therefore (44 + 20√2) cm2, or 2(22 + 10√2) cm2. The volume is calculated as (1/2 bh) l = 20 cm3.

5. B: For the stated values of a and b, the only set element common to all three sets is 1.

6. D: The first and third or the second and third branches of the circuit are represented as active in the second, fourth and eighth columns. But in the fourth column the first and second branches are indicated as active, negating the 'Light on' signal.

7. A: A maximum or minimum value of a function coincides with a point at which the slope of the tangent to the function is zero; that is, at the points at which the value of the derivative of the function is zero. For this function. dy/dx = 6x – 6, and dy/dx = 0 at x = 1. The value of the function y at x = 1 is 15.

8. B: Using the general formula for finding the roots of a quadratic equation: x = (-b ± √(b2 – 4ac.) / 2a, where a = 1, b = -2 and c = 3, substitute the values of a, b and c and complete the calculation.

9. C: The vector 'dot product' A●B is calculated as A●B = |A||B|cosθ, where |A| and |B| are the magnitudes or absolute values of the vectors A and B, and cosθ is the cosine of the angle between the two vectors A and B. The vectors both begin at the origin (0, 0). Their magnitudes are then calculated using the Pythagorean Theorem, and are found to be equivalent values of 17.09. The ratio of the y-coordinate to the respective calculated values of |A| and |B| determine the sin of the angle formed by the vectors and the x-axis. The difference between these two angles is the angle θ separating the two vectors. Substitution of the appropriate values into the formula A●B = |A||B|cosθ produces the value of the dot product A●B.

10. A: The mean range is calculated as the proportional average of the lowest value of each range and of the highest value of each range. The median range is the range in which there are an equal number of test scores in ranges greater than and less than that particular range. The mode range is the range containing the greatest number of test scores.

11. C: For two complex numbers to be identically equivalent, both the real coefficients (a and c. and the imaginary coefficients (b and d. must be identically equivalent to each other, respectively.

12. B: The set A X B = {(0, 1), (0, 3), (0,5), (0,7), (2, 1), (2, 3), (2, 5), (2, 7), (4, 1), (4, 3), (4, 5), (4, 7), (6, 1), (6, 3), (6, 5), (6, 7), (8, 1), (8, 3), (8, 5), (8, 7)} is formed by combining each element of A with each element of B, in order. The ordered pair (1, 2) is not a member of this solution set.

13. D: The total number of unique elements in the three sets combined must be equal to the total number of elements minus the elements that are shared between the pairs of sets. The final term adds back in the elements that are common to all three sets to compensate for having subtracted them twice.

14. B: One-third of 48 = 16; one-sixteenth of 48 = 3, therefore 3/16 = 9, 1/48 of 48 = 1, 1/12 of 48 = 4. This accounts for 36 individuals in the group, leaving a remainder of 12.

15. A: The events, if truly random, are independent of each other. There is therefore an equal probability of pulling the black rabbit or the white rabbit from the hat each time. The probability is therefore 0.50.

16. C: The exact method of calculating the number of ways of choosing three different items from a group of 16 different items, without repeats, is stated as "16 choose 3". The calculation is: N = 16! / ((16 – 3)!3!) = 16! / 13!3! = (16 x 15 x 14) / (3 x 2 x 1) = 560

17. A: The average is the sum of the values (60) divided by the number of values (10). The median value is the value at which there are equal numbers of greater and lesser values.

18. C: The mean value is calculated as the sum of the values (175) divided by the number of values (7). The standard deviation, s, of the sample set is calculated as the square root of the difference between the average of the actual values squared and the square of the average value.

19. C: Multiplication of (x – 3) by (x – 4) yields the quadratic formula ($x2 – 7x + 12$). When multiplied by the third factor (x + 7), this produces the formula $x3 – 37x + 84$.

20. B: Complex numbers are multiplied in exactly the same manner as algebraic factors. Here (6 + i5) (3 – i3) = 18 – i18 + i15 -15i2 = 18 + 15 – i3 – 15(-1) = 18 – i3 + 15 = 33 – i3

21. B: Since x is not equal to either 0 or 5, the value of $x2$ also cannot be equal to either 0 or 25. Of the four possible answers, a, c and d have conditions of equality with the forbidden values.

22. A: Because the complex triangle is a right triangle, the Pythagorean Theorem applies.
h2 = x2 + y2 = (6 + i3)2 + (4 + i√3)2 = (36 + i36 – 9) + (16 + i8√3 -3)
= (27 + i36) + (13 + i8√3) = 40 + i(36 + 8√3) = 40 + 4i(9 + 2√3)
Therefore, h = √(40 + 4i(9 +2√3))

23. D: The perimeter is the total length of the outside edge of the field. Because the sides of the field are orthogonal and parallel, the indented sides do not change the length of the boundaries of the field, only their relative positions.

24. C: This may be solved in two ways, each of which regards the entire field as being constructed from two smaller fields. In the first, the area of a smaller field that is 250 ft X 50 ft is subtracted from the total area encompassed in 300 ft, X 100 ft:
(300 X 100) = 30,000 sq ft
(250 X 50) = 12,500 sq ft
L-shape = 17,500 sq ft
In the second, the total area of the L-shaped field is the sum of the areas of one field that is (250 ft X 50 ft, and a second field that is (50 ft X 100 ft):
(250 X 50) = 12,500 sq ft
(50 X 100) = 5000 sq ft
L-shape = 17,500 sq ft

25. B: The general rule for the multiplication of indices is $a^x a^y = a^{x+y}$.

26. B: The series expands to 1 + 1/2 + 1/3 + 1/4 + 1/5 + 1/6
= 1 + (3/6 + 2/6 + 1/6) + 1/4 + 1/5 = 2 + 1/4 + 1/5 = 2 + 5/20 + 4/20 = 2 9/20

27. A: A six-sided die has an equal number of odd and even numbers on the six faces. The probability that an odd number will appear when the die is rolled is equal to the probability that an even number will appear, or 0.5. The eight-sided die also has an equal number of odd and even numbers on its eight faces. The probability that an odd number will appear when the die is rolled is therefore also equal to the probability that an even umber will appear, or 0.5.

28. B: The series expands to 1 + 1/1 + 2 + 1/2 + 3 + 1/3 + 4 + 1/4 = 12 1/12 = 12.08333, an infinitely repeating decimal value. It is therefore a real, rational number.

29. A: The graph in answer A is the only one that resembles the three functions.

30. C: If the region within the circle is the probability of the event A, then the region outside if the circle must represent the probability of "not A". That is, of A not occurring.

31. A: The statement as written in a. can be read "y equals three when x is less than two and y equals six when x is greater than five".

32. B: 7! = 7 x 6 x 5 x 4 x 3 x 2 x 1 and 3! = 3 x 2 x 1. The value of 7!/3! is therefore calculated as 7 x 6 x 5 x 4 = 840

33. C: Using the general formula for finding the roots of a quadratic equation x = (-b ± √ (b2 – 4ac.) / (2a. where a = 2, b = -6 and c = 2, substitute the values of a, b and c and complete the calculation to obtain the root values x = (3 ± √5) / 2 which is a real, irrational number.

34. B: When mixing ordinal and cardinal numbers the point of reference shifts by one unit. Ordinal numbering begins from 1, while cardinal numbering begins from 0.

35. D: The first three answers are easily disproved. Two, three and five are all prime numbers. The sum of three and five is eight, an even number and not a prime number. The sum of two and three is five, an odd number.

36. A: Factoring out (x – 6) leaves $2x^2 + 16x + 14 = 0$. Using the general formula for finding the roots of a quadratic equation x = (-b ± √(b2 – 4ac.) / (2a. where a = 2, b = 16 and c = 14, substitute the values of a, b and c and complete the calculation to obtain the root values x = -1 and x = -7, which are negative integers.

37. B: At the intersection points the two functions must have identical values. Substituting the value of y = (2x + 3) into the other equation and solving the resulting quadratic equation produces the root values of x = 3.40 and -5.25. The corresponding y-coordinate values are determined by substituting these values into the linear equation.

38. C: The first formula describes a straight line that passes through the origin at (0, 0), the second describes a parabola with y-intercept at +b, and the fourth describes a circle centered on the origin at (0,0) with radius |√a|.

39. A: The opposite statement must relay the equal but opposite relationship of the original conditions. The opposite of "Robert has black hair" is "Robert does not have black hair", and the opposite of "Sally does not" is "Sally does". The relation between Robert and Sally is not affected by their respective hair colors, and is thus retained by "and" in the opposite statement.

40. A: A prime number is by definition any number that can be divided integrally only by itself and 1. It therefore has no factors and so is not the product of any other numbers, prime or otherwise.

41. A: The open circle at the origin indicates that the value 0 is not included in the domain of the relation. In b., the solid circle at the origin indicates that the value 0 is part of the domain of the relation. In c. and d. the arrow extends into the negative region, which is not included in the domain of the relation.

42. C: The triangle A, when translated parallel to the y-axis by 5 units, produces the triangle B. Adding 5 to the coordinates would raise the y-coordinates the proper amount, but would also translate the triangle parallel to the x-axis by 5 units. Rotation and reflection of the figure would change the relative orientations of the apices, producing non-congruent triangles.

43. B: The circumference of the gazebo is calculated as C = pd = 94.2 feet. Since each 8-foot sheet of grillwork can be cut in two lengthwise to provide the equivalent of a 2-foot wide grillwork that is 16 feet long, a total length equivalent to 5.8875 sheets would be required, but since only whole sheets can be purchased, the contractor would be obliged to buy 6 sheets.

44. B: The diameter of the larger roller is 5/8, or 0.625, of the diameter of the smaller roller. The circumferences of the two rollers have the same relationship. When the smaller roller has turned through its full circumference then the larger roller will have turned only through 0.625 of its circumference. Thus after ten revolutions of the smaller roller, the larger roller will have turned only 6.25 times.

45. C: The relationship "A or B" indicates that one or the other is True. The opposite statement is that the statement "A or B" is False, therefore "not (A or B.". The statement "A and not B" indicates

that A is always True and B is always False. The statement "not A or not B" is equivalent to the statement "A or B". The statement "not A and B" indicates that A is always False and B is always True.

46. D: The ratio of 17.5 to 10 is 1.75. The ratio of 10 to 17.5 is 4/7 = 0.5714285, a real, rational number that is equivalent to the ratio of 2/3.5

47. C: Only (x – 1) can divide into this fourth-power equation without a remainder.

48. C: Rational numbers include fractions and integers, both odd and even, and thus do not always meet any of these conditions. They do however always have finite values; that is, they do not have an infinitely repeating or indeterminate decimal value.

49. D: The domain is the set of values allowed for x, and the range is the set of values allowed for y. Any value of x with an absolute value greater than 7 requires that the associated value of y be a complex number. Similarly, any values of y with an absolute value greater than 7 require that the associated value of x be a complex number. None of the three statements are correct statements of the domain and range of the equation.

50. B: The reflection of a symmetric function such as the parabola defined by y = 3x2 + 6 is obtained by inverting or negating the function, as -y = 3x2 + 6. This is equivalent to y = -3x2 – 6.

51. D: As the absolute value of x approaches zero, the value of the relationship approaches infinity. The value of y is undefined at x = 0 and no positive or negative value of x can result in a value of y = 0.

52. A: The function x = 1/y is identical to y = 1/x. It is a hyperbolic function occupying the (+x,+y) and (-x, -y) quadrants. The function is bisected by the line y = x, and is therefore symmetrically distributed about that line.

53. C: The sine function has the value 0 for 0 radians, +1 for p/2 radians, 0 for p radians, -1 for 3p/2 radians, and 0 for 2p radians. The cycle repeats every 2p radians.

54. D: The curve occupies the (+x, +y) and (-x, +y) quadrants, is undefined for x = 0, and approaches both the x-axis and the +y axis asymptotically. No value of x generates a value of y = 0.

55. A: There are 6 choices for the first object, five for the second, four for the third, three for the fourth, two for the fifth, and only one for the sixth. This is calculated as 6 x 5 x 4 x 3 x 2 x 1 = 6!

56. D: The full pie chart spans 360°. The segment representing 92 people out of 475 must have the same proportionality, as (92/475) x 360° = 70°.

57. A: The probability of 0.25 is equivalent to 1/4. That is, if one opportunity of four produces the result, then three chances of four produce a different result. There are three times as many opportunities for the wrong result as there are for the right result. The odds against the right result are therefore 3 to 1.

58. B: While the results can be displayed in a pie chart, like a., the segments must be properly proportioned. Similarly, the bar chart in c. and the line chart of d. could be used to display the data;

only the histogram in b. shows the relative proportions in the proper detail.

59. C: The result of each roll of the die is independent of any other roll of the die. The probability of the red spot appearing on the first roll of the die is 1/8. It is also 1/8 on the second roll, and 1/8 on the third roll. The probability of the red spot appearing on three successive rolls is 1/8 x 1/8 x 1/8.

60. C: To determine this probability one must know both the probability that (A. a given car is a police car and the probability that (B. a given car is black. The probability that a black car in the rear view mirror is a police car = the probability of A and B together divided by the probability of B.