Answer Key

1. 7.2
2. 15.15
3. 9.36
4. 11.64
5. 7.45
6. 9.89
7. 14.12
8. 13.22
9. 2.09
10. 0.18
11. {1, 2, 3, 4, 6, 8, 12, 16, 24, 48}
12. {1, 7, 49}
13. {1, 2, 5, 10, 25, 50}
14. {1, 3, 17, 51}
15. {1, 2, 4, 13, 26, 52}
16. {1, 2, 3, 6, 9, 18, 27, 54}
17. {1, 5, 11, 55}
18. {1, 3, 19, 57}
19. {1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60}
20. { 11, 13, 17, 19, 23, 29}

21. $\frac{1}{2}$
22. $\frac{2}{9}$
23. $\frac{3}{7}$
24. $\frac{3}{4}$
25. $\frac{2}{7}$
26. $\frac{2}{3}$
27. $\frac{3}{10}$
28. $\frac{2}{5}$
29. $\frac{1}{5}$
30. $\frac{1}{9}$
31. $\frac{1}{7}$
32. $\frac{1}{8}$
33. $\frac{1}{3}$
34. $\frac{8}{9}$
35. $\frac{1}{6}$
36. $\frac{8}{11}$
37. $\frac{7}{11}$
38. $\frac{9}{11}$
39. $\frac{1}{4}$
40. $\frac{3}{5}$

41. $10\frac{2}{4}$
42. $10\frac{4}{6}$
43. $10\frac{6}{8}$
44. $1\frac{8}{9}$
45. $3\frac{2}{6}$
46. $4\frac{3}{4}$
47. $1\frac{4}{6}$
48. $2\frac{5}{8}$
49. $2\frac{6}{9}$
50. $6\frac{5}{6}$
51. 66
52. 28
53. 36
54. 2 & 6 (R)
55. 6
56. 12.3
57. 80
58. 360
59. 30.8
60. 20

61. 2
62. 7
63. 216
64. 100
65. 12
66. 12.8
67. 384
68. 2
69. 12.8
70. 20
71. 9 tickets
72. 30
73. 20 quarts (smaller)
74. 2 hrs
75. 8 (pounds)
76. 5 (pounds)
77. $1920
78. $10
79. 10 (girls) 16 (boys)
80. 60 miles per hour

81. = 46 inches
82. 5 hrs
83. $3.10
84. 16 gallons
85. 16 races
86. 32 1/8 (pounds)
87. $61
88. 33 (points)
89. $30
90. 5 (M) 10 (J)
91. 5 (greens)
92. $13
93. $.50
94. 18
95. 8.4 miles
96. $14
97. 21 (quarters)
98. $10
99. $12
100. $41.45

101. 80÷4 = 20
20÷4 = 5

102. 5×5 - 3×2 = 19
19×3 = $57

103. 2.8×15 = 1.4 ×30 =
14×3
= $42

104. 132 ÷ 6 = 22

105. 91÷7 = 13

106. 90÷6×7 = 105

107. 128 ÷ 4 = 32

108. 36÷4 = 9 in

109. Each quarter has 5 nickels.
25×5 = 125

110. 7 + 6 = 13
19 - 13 = 6 (yellow)

Answer Key

1. $6\frac{3}{2} = 7\frac{1}{2}$
2. $13\frac{1}{2}$
3. $27\frac{1}{2}$
4. $50\frac{2}{3}$
5. $16\frac{1}{2}$
6. $17\frac{1}{3}$
7. $30\frac{2}{3}$
8. $29\frac{2}{3}$
9. $37\frac{1}{2}$
10. $22\frac{1}{5}$
11. 2.4
12. 27
13. 77
14. 117
15. 27
16. 63
17. 12
18. 21
19. 54
20. 70

21. 4
22. 33
23. 24
24. 21
25. 63
26. 81
27. 13
28. 24
29. 15
30. 75
31. $\frac{1}{12}$
32. $\frac{3}{8}$
33. $\frac{3}{8}$
34. $\frac{11}{30}$
35. $\frac{14}{45}$
36. $\frac{3}{10}$
37. $\frac{5}{6}$
38. $\frac{9}{20}$
39. $\frac{5}{12}$
40. $\frac{7}{72}$

41. 2.5
42. 300
43. 260
44. 0.7
45. 36
46. 4.5
47. 280
48. 2.6
49. 300
50. 6
51. 60
52. 27
53. 0.001
54. .001
55. 120
56. 40
57. 5
58. 70
59. 80
60. 38

61. 6
62. 30
63. 30
64. 30
65. 30
66. 180
67. 4
68. 10
69. 12
70. 180
71. 24 (Quin) 8 (Rachel)
72. $2
73. 1760 feet
74. $2.50
75. $580
76. 84
77. 7
78. 112
79. 5
80. 6

81. 3:55 pm
82. 8 hr & 50 min
83. $14.40
84. $3.10
85. 24
86. N/A
87. P, B, A, T
88. N/A
89. 5 & 32
90. 1000
91. 50
92. 18
93. 5
94. 65
95. ☐ = 5
96. A
97. C
98. $10.00
99. 9 cups
100. 21

101. 140 yd
102. 75°
103. 4 2/3 dozen
104. 6 weeks
105. $1.50
106. 75
107. 14
108. B
109. 6 hr
110. 7 hr 10 min
111. 10:20 am
112. 7:45 am
113. $6.50
114. 3:45 pm
115. 42 min & 16 sec
116. 54 min
117. 106 hours
118. 15 hr
119. 1 hour 59 min
120. 12 - 3×2 = 6 am

Answer Key

1. 144
2. 169
3. 289
4. 225
5. 576
6. 3, 4, 5
7. 5, 12, 13
8. 8, 15, 17
9. 7, 24, 25
10. 9, 40, 41
11. $120^2 + 241\times1 =$ 14400+241 = 14641
12. $6\frac{2}{3}$
13. $10\frac{1}{2}$
14. $4+\frac{1}{7}=4\frac{1}{7}$
15. $9+\frac{1}{7}=9\frac{1}{7}$
16. $15+\frac{1}{2}=15\frac{1}{2}$
17. $40+\frac{4}{3}=41\frac{1}{3}$
18. $80+\frac{12}{5}=82\frac{2}{5}$
19. $60+\frac{8}{3}=62\frac{2}{3}$
20. $6+\frac{27}{5}=11\frac{1}{5}$

21. $32\frac{1}{7}$
22. $74\frac{2}{35}$
23. $31\frac{1}{14}$
24. $66\frac{2}{15}$
25. $31\frac{1}{5}$
26. $47\frac{1}{7}$
27. $75\frac{2}{35}$
28. $32\frac{4}{9}$
29. $76\frac{7}{18}$
30. $60\frac{5}{32}$
31. $\frac{1}{24}$
32. $\frac{11}{160}$
33. $\frac{149}{360}$
34. $\frac{23}{140}$
35. $\frac{29}{70}$
36. $\frac{37}{105}$
37. $\frac{43}{160}$
38. $\frac{5}{18}$
39. $\frac{67}{360}$
40. $\frac{83}{300}$

41. 45
42. 9
43. 50
44. 0.2
45. 0.35
46. 0.49
47. 0.45
48. 0.0125
49. 0.225
50. 0.6
51. 1800
52. 1.6
53. 2.8
54. 900
55. 0.012
56. 0.32
57. 0.8
58. 0.12
59. 0.0625
60. 0.2

61. 240,000
62. 21,000
63. 0.032
64. 0.28
65. 1.6
66. 240
67. 0.012
68. 10
69. 0.0056
70. 0.35
71. 80,000
72. 800,000
73. 0.15
74. 0.7
75. 150,000
76. 490,000
77. 8,000
78. 5
79. 0.0008
80. 0.01

81. 4 in
82. 100 in.
83. 200 in
84. 628 in
85. 27 in^2
86. 24 in.
87. 250.
88. 13 (cm)
89. 60.
90. 225 (total area)
91. 28 (in)
92. 33 (cm^2)
93. 33
94. 35 (cm^2)
95. 50 (cm^2)
96. 35 (cm^2)
97. 20
98. 120
99. 45
100. 160

101. $\frac{1}{2}(16 + 12)\times6 = 84$
102. $0.01\times\sqrt{100}$ = $0.01\times10 = 0.1$
103. $66\times15\% = 9.9$
$66 + 9.9 = \$75.90$
104. 6 miles = 3(2 miles)
3(40 min) = 120 min
= 2 hrs
105. $4\times1.5 = 6$ mi
$4\times(\frac{1}{2}$ hour) = 2 hrs
106. $3\times7 + 1 = 22$
107. $43 - 1 = 42$
$42\div3 = 14$
108. $15\times8 = 120$ (panels a day for a washer)
$120\times5 = 600$ panels for 5 washers
$1200\div600 =$ 2 days

109. (a) false
No. Only a dog can do it.
(b)
1) a dog sails the boat.
2) the dog takes dog 2.
3) the dog takes a cat.
4) the dog takes cat 2.
5) the dog takes dog 3.
6) the dog takes cat 3.

110. 5:00 P.M.
The least common multiple of 30 and 40 is 120. So, you will hear both bell ring in 120 min, or at 5:00 P.M.

111. 900÷50000 = 1.8%
80000×1.8% = $1440.00

112. $\frac{500000}{100}\times 0.36\times 5$
= 5000×0.36×5 (cancellation)
= 50×36×5 (moving decimal)
= 10×180×5
= 1800×5
= $9000.00

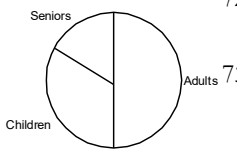
113. 1 + 20% = 1.2
60×1.2 = $72

114. B

115. $\frac{\text{tax}}{\text{cost witout tax}} = \frac{54-50}{50} = \frac{4}{50} = 8\%$

Answer Key

1. -6, $3x + 6$
2. -2, $4x + 1$
3. -9, $2x + 3$
4. -16, $3x + 4$
5. 20, $x - 4$
6. 5, $2x + 5$
7. -4, $3x - 2$
8. 9, $x + 3$
9. 16, $3x + 4$
10. 25, $2x + 5$
11. $7x^4 - 10x^3 - 15x^2$
12. $12x^3 + 12x^2 + 8x + 12$
13. $5x^4 - 3x^3 - 7x^2$
14. $6x^3 - 2x^2 + x - 2$
15. $18x^2 - 9x + 3$
16. $15x^2 - 14x + 8$
17. $8x^2 + 2x - 6$
18. $-4x^3 - 2x^2 - 12x$
19. $4x^3 + 16x^2 + 10x - 4$
20. $14x^3 + 14x^2 + 10x$
21. $32x^3 - 4x$
22. $4x^4 + 6x^2 - 2x$
23. $4x^4 - 6x^3 + 12x^2$
24. $18x^3 + 14x^2 + 10x$
25. $6x^4 - 9x^3 - 12x^2 - 3x$
26. $2x^3 + 2x^2 - 4x + 6$
27. $4x^4 - 4x^3 - 2x^2 - 6x$
28. $-36x^2 + 3x + 13$
29. $-2x^4 - 6x^3 - 4x^2 + 4x + 4$
30. $9x^3 + 10x^2 - 4x - 6$
31. $x^2 - 7x + 6$
32. $x^2 - x - 30$
33. $x^2 - 9x + 18$
34. $1.2x^2 - 4.8x - 14.4$
35. $15x^2 - 150x + 360$
36. $2.5x^2 - 7.5x - 45$
37. $1.5x^2 + 7x + 4$
38. $-2x^2 + \frac{1}{3}x + 4$
39. $12x^2 + 10x + 2$
40. $-3x^2 - 4.4x + 1$
41. $33x + 14$
42. $21x + 26$
43. 10
44. $4x^6$
45. $12x^2$
46. 6
47. $-11x$
48. $-7x^3$
49. $8x^2 - 3x + 18$
50. $-2x^2 + 3x - 4$
51. $5x^2 + 10x + 2$
52. $6x + 3 - 3x^2 + 12x + 6$
    $= -3x^2 + 18x + 9$
53. $2(3x^2 - 4x + 7) + 3(5x^2 + x + 11)$
    $= 6x^2 - 8x + 14 + 15x^2 + 3x + 33$
    $= 21x^2 - 5x + 47$
54. $3(2x^2 + 3) + 2(-4x^2 + 3x - 7)$
    $= 6x^2 + 9 - 8x^2 + 6x - 14$
    $= -2x^2 + 6x - 5$
55. $\frac{1}{2}(4x^3 + 8) + \frac{1}{3}(-6x + 3) - \frac{1}{5}(2x^3 - 20x^2 + 15)$
    $= 2x^3 + 4 - 2x + 1 - 0.4x^3 + 4x^2 - 3$
    $= 1.6x^3 + 4x^2 - 2x + 2$
56. $1.1(4x^3 + 7x + 8) - 3.2(4x^3 - 2x^2 + 3)$
    $= 4.4x^3 + 7.7x + 8.8 - 12.8x^3 + 6.4x^2 - 9.6$
    $= -8.4x^3 + 6.4x^2 + 7.7x - 0.8$
57. $1 - \frac{3}{5} = \frac{2}{5} = 2/5$
58. $35 \times \frac{2}{5} = 14$
59. $120 \div 6 = 20$
    $480 \div 20 = 24$ gal
60. 15%
61. See the chart below.



62. B
63. 3 3/8
64. Method I)
    $\frac{80+70+60+90+80}{5} = 76$

    Method II)
    Move 10 points from the last test to the third one. Now all marks exceed 70 points. The first one has a surplus of 80 – 70 = 10 points, while the fourth one has a 90 – 70 = 20 points. Therefore, the total surplus is
    10 + 20 = 30
    30÷5 = 6
    70 + 6 = 76
65. $39 \div 3 = 13$
    $13 + 9 = 22$
66. $9 \times 8 = 72$ in = 6 ft
67. A
    SUV is more efficient.
    SUV: 240÷8 = 30 (mpg)
    MIN: 299÷11 < 30 (mpg)
68. 184 ÷ 8 = 23 miles per gallon
69. $\frac{35}{40} \times 376 = \frac{7}{8} \times 376 =$
    $47 \times 7 = \$329$
70. 8/7
71. $\frac{2}{3} = 2/3$
72. $35 \div (1 - 30\%) =$
    $35 \div 0.7 = \$50$
73. $0.8 \times \mathbf{3000} = 2400$
    or
    $2400 \div 0.8 = \$3{,}000$
74. $\frac{5000-4000}{5000} = 0.2 = 20\%$
75. $80 \times 30\% = 80 \times 0.3 =$
    \$24
76. $1 - 80\% = 20\%$
77. $60 \times 0.3 = \$18.00$
78. Method (I)
    $60 - 18 = \$42$
    Method (II)
    $60 \times 0.7 = 42$
79. $6 \div 15\% = 6 \div 0.15 =$
    $600 \div 15 = 40$ ft
80. $31.5 - 30 = \$1.50$
81. $1.5 \div 30 = 0.05 = 5\%$
82. $1 - 20\% = 1 - 0.2 = 0.8$
    $200 \times 0.8 = 160$
83. $2 \times (1 + 25\%)$
    $= 2 \times 1.25$
    $= 2.5$ gal
    = 2 gal 4 pints
84. $200 \times (1 + 20\%)$
    $= 200 \times 1.2$
    = \$240
85. $200 \times (1 + 15\%)$
    $= 200 \times 1.15$
    $= 2 \times 115$
    $= 230$
86. $240 \times (1 - 12\% - 18\%)$
    $= 168$

Answer Key

1. a =-5, b = 1, c =-1
2. a = 7, b = 3, c = 14
3. a = 7, b = 3, c = 33
4. a =-1, b = 3, c =-27
5. a = 1, b =-3, c = 1
6. a =-5, b = 4, c = 1
7. a = 7, b =-7, c = 3
8. a = 1, b =-2, c = 6
9. a = 7, b = 4, c = 9
10. a =-1, b =-8, c = 9
11. $\frac{5}{3} = 1\frac{2}{3}$
12. $\frac{21}{5} = 4\frac{1}{5}$
13. $6 + \frac{8}{5} = 7\frac{3}{5}$
14. $24 + \frac{8}{7} = 25\frac{1}{7}$
15. $12 + \frac{6}{5} = 13\frac{1}{5}$
16. $18 + \frac{12}{7} = 19\frac{5}{7}$
17. $30 + \frac{5}{3} = 31\frac{2}{3}$
18. $32 + \frac{8}{5} = 33\frac{3}{5}$
19. $75 + \frac{5}{2} = 77\frac{1}{2}$
20. $48 + \frac{8}{3} = 50\frac{2}{3}$
21. 6, 5, -6
22. 4, 15, 9
23. 4, 2, 0, -1
24. 6, 4, 1, -1
25. 3, 4, -7
26. 3, 2, 11
27. 4, 1, 0
28. 3, 3, -1
29. 1, -1, 1
30. 2, 2, 1
31. $(x - 2)(x + 3) = x^2 + (3 - 2)x + (-2)(3) = x^2 + x - 6$
    $(x + 2)(x - 3) = x^2 - x - 6$
32. $(3x - 2)(2x + 3) = 6x^2 + 5x - 6$
    $(3x + 2)(2x - 3) = 6x^2 - 5x - 6$
33. $n^2 - 7n + 12$
    $n^2 + 7n + 12$
34. $y^2 - 4y - 21$
    $y^2 + 4y - 21$
35. $15x^2 + 41x + 14$
    $15x^2 - 41x + 14$
36. $15x^2 + 29x - 14$
    $15x^2 - 29x - 14$
37. $24x^2 + 41x - 35$
    $24x^2 - 41x - 35$
38. $3x^3 - 8x^2 - 22x + 24$
39. $x^3 + 8x^2 + 14x + 4$
40. $x^6 + 8x^4 + 14x^2 + 4$
41. $(x + 1)(x + 2)$
42. $(x + 1)(x + 8)$
43. $(x + 3)(x + 10)$
44. $(x - 8)(x - 4)$
45. $(x - 2)(x + 9)$
46. $(4x - 5)(3x + 1)$
47. $(3x + 2)(x - 10)$
48. $(2x - 9)(x - 3)$
49. $(x + 8)(3x + 4)$
50. $(2x + 3)(5x + 1)$
51. B
52. D
53. C
54. C
55. A
56. C
57. B
    vertex and corresponding angles
58. C
59. C
60. D
61. B
62. B
63. D
64. B
65. B
66. A
67. B
68. -64
69. D
70. B

Answer Key

1. $f(0) = 75$
   $f(4) = 0.12$
   $f(x) = 75(0.2^x)$
2. $f(0) = 2$
   $f(6) = 128$
   $f(x) = 2(2^x)$
3. $f(0) = -4$
   $f(4) = -64$
   $f(x) = -4(2^x)$
4. $f(0) = 60$
   $f(-1) = 100$
   $f(x) = 60(0.6^x)$
5. $f(0) = 0.12$
   $f(4) = 75$
   $f(x) = 0.12(5^x)$
6. 2, 7, 3
7. 2, 1, -6
8. 2, -1, 1, 1
9. 2, -1, -8, -3
10. 1, -5, -2
11. 2, 5, 18
12. 2, -8, 7
13. 8, -5, -6
14. 2, 1, 1
15. 2, 2, -1
16. 1.96
17. 0.04
18. 0.008
19. 0.0016
20. 0.09
21. 0.027
22. 0.16
23. 0.064
24. 0.25
25. 0.125
26. 2
27. 2
28. 2
29. 6
30. 2
31. 4
32. 3
33. 2
34. 2
35. $1\frac{1}{2}$
36. $\frac{5}{6} + \frac{2}{3} = 1\frac{1}{2}$
37. $\frac{7}{10} + \frac{1}{2} = 1\frac{1}{5}$
38. $\frac{9}{3} + \frac{2}{3} = 3\frac{2}{3}$
39. $\frac{7}{8} + \frac{1}{3} + \frac{1}{2} = 1\frac{17}{24}$
40. $\frac{6}{7} + \frac{2}{5} + \frac{2}{1} = 3\frac{9}{35}$
41. $3(3x - 8)(7x + 6)$
42. $5(5x + 8)(6x + 5)$
43. $4(x + 6)(8x - 1)$
44. $2(3x + 4)(6x + 5)$
45. $-5(5x + 2)(3x - 5)$

46. 6 min

stamping machine	fraction of a part that can be completed in one sec
older model	$\frac{1}{18}$
newer model	$\frac{1}{12}$
both models	$\frac{1}{18} + \frac{1}{12} = \frac{5}{36}$

$\frac{50}{\frac{1}{18}+\frac{1}{12}} = 50/\frac{5}{36} = 360$ sec $= 6$ min

Pump	part of the tank can be filled in one min
Pump A	$\frac{1}{30}$
Pump B	$\frac{1}{45}$
both Pumps	$\frac{1}{30} + \frac{1}{45} = \frac{1}{18}$

47. It takes $\boxed{18 \text{ min}}$ for both pumps to fill the tank.

48. $\frac{1}{30}+\frac{1}{45} - \frac{1}{90} = \frac{2}{45}$
It takes $\boxed{22.5}$ min for both pumps to fill the tank while the drain pipe is open.

49. $\frac{70}{\frac{1}{10}+\frac{1}{10}+\frac{1}{10}+\frac{1}{6}} = \boxed{150 \text{ sec}}$

50. Let x be the distance in km.
$\frac{x}{15} = \frac{x}{30} + \frac{1}{4}$
$4x = 2x + 15$
$x = \boxed{7.5 \text{ km}}$

51. Let x km be the length of the first leg (part) of the race, thus the remainder is $12 - x$ km. We have
$\frac{x}{9} + \frac{12-x}{10} = 1\frac{1}{4}$
$20x + 18(12 - x) = 225$
$2x = 9$
$x = \boxed{4.5 \text{ km}}$

52. Let x miles be the length of city driving, thus $150 - x$ miles be the length of the highway driving. The total number gallons of gas is
$\frac{150}{20} = 7.5$
He spend $\frac{x}{18}$ and $\frac{150-x}{24}$ gallons of gas on city and highway driving, respectively. Thus, we have
$\frac{x}{18} + \frac{150-x}{24} = 7.5$
$4x + 3(150 - x) = 540$
$x = \boxed{90 \text{ mi}}$

53. Let x g of pure hydrogen perox*i*de be added. Thus, we have
$x + 240\times0.45 = (x + 240)\times0.7$
$x + 108 = 0.7x + 168$
$0.3x = 60$
$x = \boxed{200 \text{ g}}$

54. Let x (g) of nitric solution be added. Then, we have
$80\%\times x + 12\%\times175 = 60\%\times(x + 175)$
$0.8x + 21 = 0.6x + 105$
$0.2x = 84$
$x = \boxed{420 \text{ g}}$

55. $\frac{1-6(\frac{2}{25})}{\frac{2}{25}+\frac{1}{20}} = 4$
$6 + 4 = \boxed{10 \text{ min}}$

56. Let x (min) be the length of time before the first machine breaks down. Therefore, we have
$\frac{1-\frac{x}{18}}{\frac{1}{60}+\frac{1}{60}} = 20$
$1 - \frac{x}{18} = \frac{2}{3}$
$18 - x = 12$
$x = \boxed{6 \text{ min}}$

57. For the first 30 km, she spent $\frac{3}{4}$ hr. Let x (km) be the distance she traveled further at the speed of 60 km/h. Then, the total time she traveled is

$$\frac{3}{4} + \frac{x}{60} = \frac{45+x}{60}$$

so the average speed is

$$\frac{\text{total distance}}{\text{total time}} = \frac{30+x}{\frac{3}{4}+\frac{x}{60}} = 54$$

$$30 + x = 54\left(\frac{3}{4} + \frac{x}{60}\right)$$

$$30 + x = 54 \times \frac{45+x}{60}$$

$$10(30 + x) = 9(45 + x)$$

$$300 + 10x = 405 + 9x$$

$x = \boxed{105 \text{ km}}$

58. Let x (min) be needed for the second copy machine. Every minute the total part of the work performed is

$$\frac{1}{30} + \frac{1}{x} = \frac{1}{18}$$

$$9x + 270 = 15x$$

$$6x = 270$$

$x = \boxed{45 \text{ min}}$

59. Let x (hr) be the length of time needed by the third machine alone. Then, we have

$$\frac{2}{15} + \frac{1}{x} = \frac{1}{3}$$

$$2x + 15 = 5$$

$x = \boxed{5 \text{ hr}}$

60. Let x (hr) be the length of time needed to complete the job by a newer model machine, then $x + 6$ (hr) be needed by an older model machine. The fraction of work that can be accomplished by 2 newer model machines is $\frac{2}{x}$, while the fraction of work that can be accomplished by 3 older model machines is $\frac{3}{x+6}$. Since the combined work accomplished by 5 of these machines in one single hour is the whole job, we have

$$\frac{3}{x+6} + \frac{2}{x} = \frac{1}{1}$$

$$3x + 2(x + 6) = x(x + 6)$$

$$5x + 12 = x^2 + 6x$$

$$x^2 + x - 12 = 0$$

$$(x + 4)(x - 3) = 0$$

$x = \boxed{3 \text{ hr}}$ (-4 not desired)

61. Let x (mi/h) be the speed going to and $x - 6$ on the way returning from the meeting.

$$\frac{72}{x} + \frac{2}{15} = \frac{72}{x-6}$$

$$72(x - 6) + \frac{2}{15}x(x - 6) = 72x$$

$$\frac{2}{15}x(x - 6) - 432 = 0$$

$$x(x - 6) - 3240 = 0$$

$$x^2 - 6x - 3240 = 0$$

$$(x - 60)(x + 54) = 0$$

$x = \boxed{60 \text{ km/h}}$ (-54 not desired)

62. Let x (hr) be the length of time he worked before raise. His hourly rate was $\frac{63}{x}$¢/h, while his current rate is $\frac{63}{x}+75$ ¢/h. We have

$(\frac{63}{x}+\frac{3}{4})\times(x-2) = 68$

$(3x+252)(x-2) = 272x$

$3x^2 - 26x - 504 = 0$

$(3x + 28)(x - 18) = 0$

$x =$ 18 hr (-28/3 not desired)

63. Let x km/h be the speed of the current, then the combined speed of going up stream is $15 - x$ and the combined speed of going down stream is $15 + x$. Thus, the total time equals the sum of up stream time and down stream time:

$T_{total} = T_{up\ stream} + T_{down\ stream}$

$\frac{5}{6} = \frac{6}{15-x} + \frac{6}{15+x}$

$\frac{5}{6} = \frac{180}{(15-x)(15+x)}$

$\frac{1}{6} = \frac{36}{(15-x)(15+x)}$

$225 - x^2 = 216$

$x^2 = 9$

$x =$ 3 km/h (-3 not desired)

64. Let x km/h be the speed of the boat. Then, the combined up stream speed is $x - 2$ and the combined down stream is $x + 2$. Since

$T_{up\ stream} + T_{down\ stream}$ = paddle 25 km in still water

$\frac{12}{x-2} + \frac{12}{x+2} = \frac{25}{x}$

$24x^2 = 25(x^2 - 4)$

$x^2 = 100$

$x =$ 10 km/hr (-10 not desired)

65. We have the following relations:

	# days needed	part of work accomplished a day
day laborer	$x + 3$	$\frac{1}{x+3}$
apprentice	x	$\frac{1}{x}$
master	$x - 3$	$\frac{1}{x-3}$

The part of work accomplished by master in 7 days is

$\frac{7}{x-3}$

The part of work accomplished by apprentice and day laborer in 6 days is

$6(\frac{1}{x}+\frac{1}{x+3})$

Thus, we have

$\frac{7}{x-3} = 6(\frac{1}{x}+\frac{1}{x+3})$

$7x(x + 3) = 6(x - 3)(2x + 3)$

$7x^2 + 21x = 6(2x^2 - 3x - 9)$

$7x^2 + 21x = 12x^2 - 18x - 54$

$5x^2 - 39x - 54 = 0$

$(5x + 6)(x - 9) = 0$

$x =$ 9 days (-1.2 not desired)

66. $\frac{1}{\frac{1}{0.4}-\frac{1}{0.5}+\frac{1}{4.5}-\frac{1}{1.5}}$

$= \frac{36}{90-72+8-24}$

$=$ 18 hr

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

68. $\frac{5}{3}$

69. $\frac{8}{9}$

70. $\frac{8}{5}$

71. $\frac{7}{4}$

72. $\frac{8}{7}$

73. $\frac{7}{6}$

74. $\frac{8}{7}$

75. $\frac{9}{7}$

76. $\frac{7}{6}$

77. $\alpha + \beta = -1$

78. $\alpha\beta = -1$

79. $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = 3$

80. $\alpha^3 + \beta^3 = (\alpha + \beta)^3 - 3\alpha\beta(\alpha + \beta) = -1 - 3 = -4$

81. $\alpha - \beta = ((\alpha + \beta)^2 - 4\alpha\beta)^{\frac{1}{2}} = \sqrt{5}$

82. $\alpha^3\beta + \alpha\beta^3 = \alpha\beta(\alpha^2+\beta^2) = -1\times3 = -3$.

83. $\alpha + \beta = -\frac{3}{2}$

84. $\alpha\beta = -\frac{5}{2}$

85. Let a and b be the length of the rectangle. Since we have $2(a + b) = p$ or
(i) $a + b = \frac{1}{2}p$, and
(ii) $ab = q$
From (i) and (ii), we have $a^2 + b^2 = (a + b)^2 - 2ab = \frac{1}{4}p^2 - 2q$, thus the length of the diagonal is $\sqrt{\frac{1}{4}p^2 - 2q}$

86. $\frac{(5-\sqrt{6x})(\sqrt{6x}+5)}{7x-2} + \frac{3x+2}{7x-2}$
$= \frac{25-6x}{7x-2} + \frac{3x+2}{7x-2}$
$= \frac{27-3x}{7x-2}$

87. $8(x + 3a) = 2(6 + 2a)$
$2(x + 3a) = 3 + a$
$2x = 3 - 5a$
$x = \frac{3-5a}{2}$

88. $x^2 + bx + 9 + y^2 = 16$
$(x + 3)^2 + y^2 = 4$
$b = \boxed{6}$

89. $(-3i - i)^2 - (-1 + 2i)^2$
$= (4i)^2 - (-1 + 2i)^2$
$= -16 + 3 + 4i$
$= -13 + 4i$

90. $-5.6 < x - 3 < 7$
$-2.6 < x < 10$
$-85.6 < 33x < 330$