

Spring 2018

**Simplify. Write the results in the form  $a+bi$** 

1)  $-4i - (5 + 5i) - 3$

2)  $3 + 4i - 5 - 3i$

3)  $-4 + 2i - 3 - i$

4)  $(-2 - 3i)(-5 + 5i)$

**Simplify.**

5)  $\frac{1}{-10i}$

6)  $\frac{2 - 9i}{8 + 7i}$

7)  $\frac{2i}{9 - 7i}$

**Evaluate each function.**

8)  $p(x) = 4x + 5$ ; Find  $p(-8)$

9)  $f(t) = t^2 - 1$ ; Find  $f(7)$

10)  $f(n) = -4n - 4$ ; Find  $f(n + 4)$

11)  $g(x) = x^2 - 4x$ ; Find  $g(3x)$

**Perform the indicated operation.**

12)  $f(x) = 4x + 2$   
 $g(x) = 2x + 1$   
Find  $\frac{f}{g}$

13)  $g(x) = 4x + 5$   
 $f(x) = -4x + 1$   
Find  $f - g$

14)  $g(x) = 3x + 4$   
 $f(x) = 3x^2 + 4x$   
Find  $(g + f)(1)$

15)  $h(n) = 4n + 2$   
 $g(n) = n^2 - 3$   
Find  $hg(0)$

16)  $f(n) = 2n - 1$   
 $g(n) = n^3 + 5n^2$   
Find  $(f \circ g)(n)$

17)  $h(x) = -3x^2 + 2x$   
Find  $(h \circ h)(x)$

Identify the domain.

18)  $y = \sqrt{x+1}$

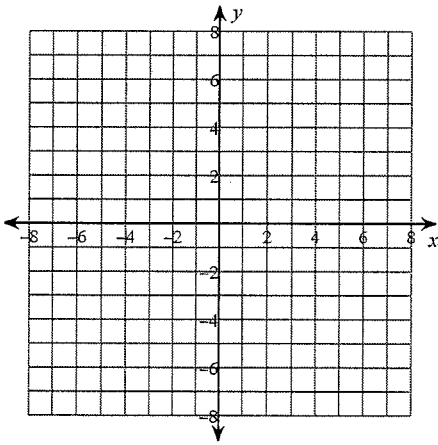
19)  $y = \sqrt{x+3}$

20)  $f(x) = \frac{x^3 - 4x}{x^3 - x^2 - 2x}$

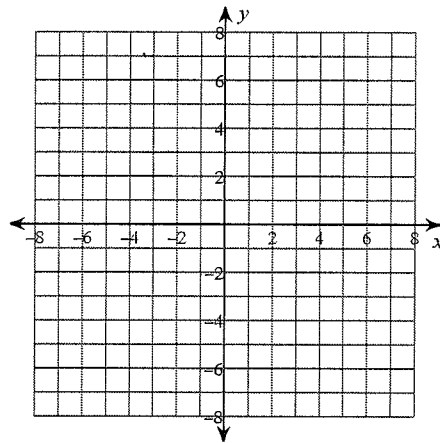
21)  $f(x) = \frac{x^2 + 2x}{4x^2 + 4x - 24}$

Sketch the graph of each function.

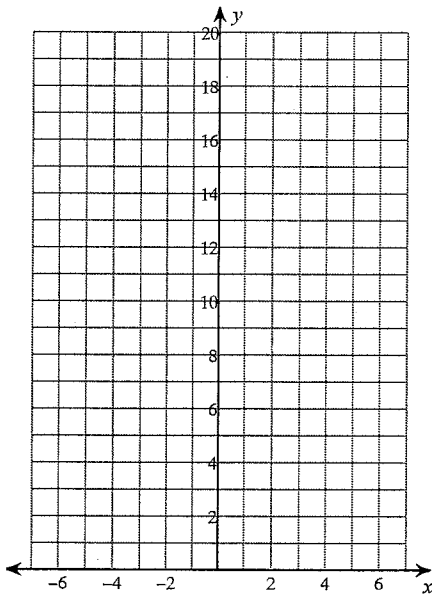
22)  $f(x) = 2x^2 - 8x + 2$



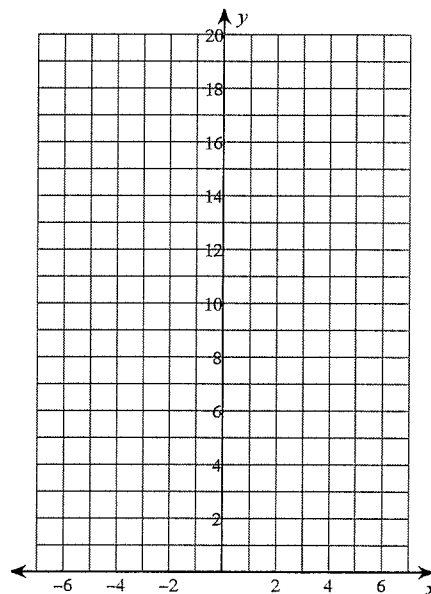
23)  $f(x) = \begin{cases} -4, & x \leq -2 \\ 1, & x > -2 \end{cases}$



24)  $f(x) = \left(\frac{1}{2}\right)^x$



25)  $f(x) = \left(\frac{1}{3}\right)^x$



For each problem, find the average rate of change of the function over the given interval.

26)  $f(x) = x^2 - 2$ ;  $[-2, 4]$

27)  $f(x) = x^2 - 2x + 2$ ;  $[1, 2]$

Describe the transformations necessary to transform the graph of  $f(x)$  into that of  $g(x)$ .

28)  $f(x) = x^3$   
 $g(x) = 3x^3 - 3$

29)  $f(x) = x^2$   
 $g(x) = -x^2 - 3$

30)  $f(x) = |x|$   
 $g(x) = -|x + 5| - 2$

31)  $f(x) = \sqrt{x}$   
 $g(x) = \sqrt{x + 4}$

Find the inverse of each function.

32)  $f(x) = \frac{2}{x + 1} - 1$

33)  $g(x) = -4 - \frac{1}{2}x$

Rewrite each equation in exponential form.

34)  $\log_{\frac{1}{11}} \frac{1}{121} = 2$

35)  $\log_{121} 11 = \frac{1}{2}$

36)  $\log_{15} 225 = 2$

37)  $\log_7 \frac{1}{49} = -2$

Rewrite each equation in logarithmic form.

38)  $9^{-2} = \frac{1}{81}$

39)  $19^y = x$

40)  $16^x = y$

41)  $x^y = 140$

Evaluate each expression.

42)  $\log_7 \frac{1}{343}$

43)  $\log_6 36$

44)  $\log_9 3$

45)  $\log_8 2$

Use a calculator to approximate each to three decimal places.

46)  $\log_6 34$

47)  $\log_{59} 4$

Solve each equation.

48)  $\log_{15} (-3n - 1) = \log_{15} -2n$

49)  $\log_{19} (9 - 2m) = \log_{19} (-m + 10)$

50)  $\log_2 3 + \log_2 (x^2 - 2) = 2$

51)  $\log_8 (x + 6) - \log_8 x = 1$

52)  $\log_3 4 + \log_3 (x - 7) = 2$

53)  $\log_9 3x^2 + \log_9 3 = 5$

Condense each expression to a single logarithm.

54)  $\log_5 z + \frac{\log_5 x}{3} + \frac{\log_5 y}{3}$

55)  $\frac{\log_2 x}{2} + \frac{\log_2 y}{2} + \frac{\log_2 z}{2}$

56)  $2\log_7 x - 4\log_7 y$

57)  $6\log_5 x + 24\log_5 y$

Expand each logarithm.

58)  $\log_6 (uv^6)^2$

59)  $\log_2 (x^4 y^5)$

60)  $\log_8 (a \cdot b \cdot c^4)$

61)  $\log_6 \left(\frac{a}{b^5}\right)^6$

Solve each equation. Round your answers to four decimal places.

62)  $15^{-4r} + 1 = 77$

63)  $-4 \cdot 13^{-4a} = -68.5$

- 64) Jennifer invests \$7,963 in a savings account with annual interest rate of 3% compounded 4 times per year. What will the account balance be after 4 years? (Round to nearest penny)
- 65) Abhasra invests \$3,788 in a retirement account with annual interest rate of 9% compounded continuously. What will the account balance be after 17 years? (Round to nearest penny)
- 66) Danielle invests \$3,339 in a savings account with annual interest rate of 9% compounded continuously. How long will it take for the account balance to reach \$4,500? (Round to 1 decimal place)
- 67) The fox population in a certain region has a relative growth rate of 8% per year. It is estimated that the population in 2013 was 18,000.
- Find a function  $n(t) = n_0 e^{rt}$  that models the population
  - Use the function from part (a) to estimate the fox population in the year 2021.
  - After how many years will the fox population reach 25,000?
- 68) A grey squirrel population was introduced in a certain county of Great Britain 30 years ago. Biologists observe that the population doubles every 6 years, and now the population is 100,000.
- What was the initial size of the squirrel population?
  - Estimate the squirrel population 10 years from now.

**Convert each degree measure into radians.**

69)  $-150^\circ$

70)  $-310^\circ$

71)  $100^\circ$

72)  $265^\circ$

**Convert each radian measure into degrees.**

73)  $\frac{149\pi}{36}$

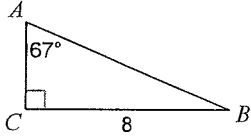
74)  $\frac{29\pi}{12}$

75)  $\frac{10\pi}{9}$

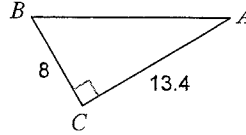
76)  $\frac{2\pi}{3}$

Solve each triangle. Round answers to one decimal place.

77)



78)



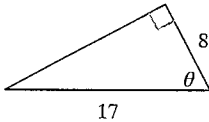
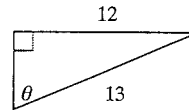
79) The base of a ladder is 6 ft from the building, and the angle formed by the ladder and the ground is 73°. How high up the building does the ladder touch?

80) A 96-ft tree casts a shadow that is 120 ft long. What is the angle of elevation of the sun?

Find the value of the trig function indicated.  $\theta$  is in quadrant 1.

81) Find  $\tan \theta$  if  $\csc \theta = \frac{25}{24}$

82) Find  $\sec \theta$  if  $\cos \theta = \frac{\sqrt{15}}{4}$

83)  $\tan \theta$ 84)  $\sin \theta$ 

Find the exact value of each trigonometric function.

85)  $\sin 900^\circ$

86)  $\csc \frac{19\pi}{4}$

87)  $\cos 660^\circ$

88)  $\tan 1050^\circ$

89)  $\sin \left(-\frac{10\pi}{3}\right)$

90)  $\cos (-240^\circ)$

91)  $\sec 600^\circ$

92)  $\cos -\frac{11\pi}{3}$

93)  $\tan 690^\circ$

94)  $\sin\left(-\frac{16\pi}{3}\right)$

Find the amplitude, the period, the phase shift, and the vertical shift. Then sketch one period of the graph.

95)  $y = 4\sin\left(2\theta - \frac{\pi}{2}\right)$

96)  $y = \cos\left(\theta - \frac{\pi}{2}\right)$

97)  $y = \frac{1}{2} \cdot \tan \frac{\theta}{2}$

98)  $y = \sec 2\theta$

Graph each function using radians.

99)  $y = 2\cos\left(4\theta + \frac{\pi}{2}\right) + 2$

Find the exact value of each expression.

100)  $\tan^{-1} \sqrt{3}$

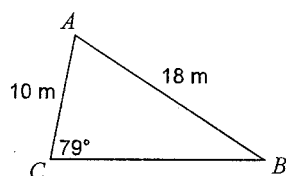
101)  $\sin^{-1} -\frac{1}{2}$

102)  $\sec(\arctan 5/4)$

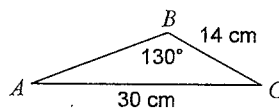
103)  $\cos(\arcsin 5/13)$

Find each measurement indicated. Round your answers to the one decimal place.

104) Find  $m\angle B$



105) Find  $m\angle A$



**Solve each triangle. Round your answers to the nearest tenth.**

106)  $m\angle B = 139^\circ$ ,  $m\angle A = 34^\circ$ ,  $c = 5$

107)  $m\angle B = 22^\circ$ ,  $a = 33$ ,  $b = 27$

108)  $m\angle B = 81^\circ$ ,  $a = 32$ ,  $b = 9$

109)  $m\angle A = 54^\circ$ ,  $m\angle C = 94^\circ$ ,  $c = 32$

110)  $b = 24$ ,  $a = 18$ ,  $c = 26$

111)  $m\angle A = 77^\circ$ ,  $b = 17$ ,  $c = 15$

**Verify each identity.**

112) 
$$\frac{\sin x + \sec x}{\sec x} = \sin x \cos x + 1$$

113) 
$$\tan x + \sec x = \frac{\sin x + 1}{\cos x}$$

114) 
$$\frac{\sin(x+y) + \sin(x-y)}{\cos(x+y) + \cos(x-y)} = \tan x$$

115) 
$$(\sin x + \cos x)^2 = 1 + 2\sin x \cos x$$

116) 
$$\frac{1}{1 - \sin^2 x} = 1 + \tan^2 x$$

**Find the exact value of each.**

117)  $\sin 195^\circ$

118)  $\cos 75^\circ$

119)  $\tan x = \frac{4}{3}$  where  $0 \leq x < 90^\circ$

120)  $\cos x = \frac{4}{5}$  where  $270^\circ < x < 360^\circ$

Find a)  $\sin 2x$ , b)  $\cos 2x$ , c)  $\tan 2x$

Find a)  $\sin \frac{x}{2}$ , b)  $\cos \frac{x}{2}$ , c)  $\tan \frac{x}{2}$

121)  $\cos 22.5^\circ$



**Find all solutions to each equation.**

122)  $\sin \theta \cdot (\cos \theta - 2) = 0$

123)  $4 + 3\tan \theta = 7$

124)  $\cos \theta = -\frac{1}{3}$

125)  $2\sin^2 \theta = -2\sin \theta + 3\sin^2 \theta + 1$

126)  $2\cos 2\theta + 1 = 0$

**Plot the point with the given polar coordinates.**

127)  $\left(-2, \frac{11\pi}{12}\right)$

128)  $\left(1, \frac{5\pi}{4}\right)$

**Convert each pair of polar coordinates to rectangular coordinates.**

129)  $\left(3, -\frac{3\pi}{4}\right)$

130)  $\left(4, -\frac{\pi}{6}\right)$

**Convert each pair of rectangular coordinates to polar coordinates where  $r > 0$  and  $0 \leq \theta < 2\pi$ .**

131)  $\left(-\frac{3\sqrt{3}}{2}, -\frac{3}{2}\right)$

132)  $\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

**Convert each equation from rectangular to polar form.**

133)  $y = \frac{x}{5}$

134)  $x^2 + y^2 = 9$

**Convert each equation from polar to rectangular form.**

135)  $r = -6\cos \theta - 2\sin \theta$

136)  $\tan \theta = 4$

**Find the modulus (absolute value).**

137)  $-6 + 6i$

138)  $-3 - 3i\sqrt{3}$

**Plot each point in the complex plane.**

139)  $-5 + 4i$

140)  $5 + 3i$

**Write each in polar form.**

141)  $-4i$

142)  $3\sqrt{3} - 3i$

**Simplify. Write your answer in rectangular form.**

143)  $(-2 - 2i)^4$

144)  $(3 + 5i)^3$

**Find the component form of the resultant vector.**

145)  $\mathbf{a} = \langle -1, 0 \rangle$   
Find:  $-8\mathbf{a}$

146)  $\mathbf{u} = \langle 14, 48 \rangle$   
Find:  $-7\mathbf{u}$

147)  $\mathbf{f} = \langle -11, -2 \rangle$   
 $\mathbf{v} = \langle -2, -12 \rangle$   
Find:  $\mathbf{f} + \mathbf{v}$

148)  $\mathbf{a} = \langle 8, -9 \rangle$   
 $\mathbf{g} = \langle 7, -2 \rangle$   
Find:  $\mathbf{a} - \mathbf{g}$

**Find the magnitude and direction angle for each vector.**

149)  $\mathbf{b} = \langle 48, -34 \rangle$

150)  $\mathbf{n} = \langle 12, 22 \rangle$

151)  $\mathbf{k} = \langle -1, -2\sqrt{30} \rangle$

**Find the dot product of the given vectors.**

152)  $\mathbf{u} = \langle -7, -3 \rangle$   
 $\mathbf{v} = \langle -2, -2 \rangle$

153)  $\mathbf{u} = \langle 9, -6 \rangle$   
 $\mathbf{v} = \langle 6, 5 \rangle$

**Find the measure of the angle between the two vectors.**

154)  $\mathbf{u} = \langle 0, -7 \rangle$   
 $\mathbf{v} = \langle 8, 6 \rangle$

155)  $\mathbf{u} = \langle -7, 5 \rangle$   
 $\mathbf{v} = \langle 0, 8 \rangle$

# Answers to Spring 2018

1)  $-8 - 9i$

2)  $-2 + i$

3)  $-7 + i$

4)  $25 + 5i$

5)  $\frac{i}{10}$

6)  $\frac{-47 - 86i}{113}$

7)  $\frac{-7 + 9i}{65}$

8)  $-27$

9) 48

10)  $-4n - 20$

11)  $9x^2 - 12x$

12)  $\frac{4x + 2}{2x + 1}$

13)  $-8x - 4$

14) 14

15)  $-6$

16)  $2n^3 + 10n^2 - 1$

17)  $-27x^4 + 36x^3 - 18x^2 + 4x$

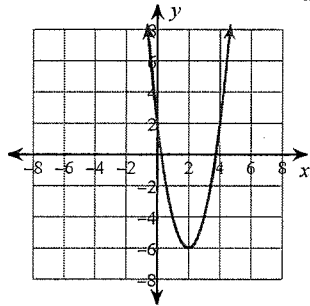
18) Domain:  $x \geq 0$

19) Domain:  $x \geq -3$

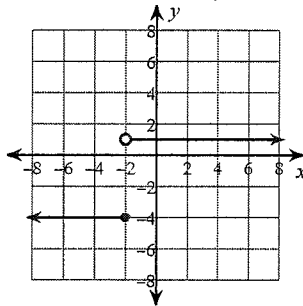
20) Domain: All reals except  $-1, 0, 2$

21) Domain: All reals except  $2, -3$

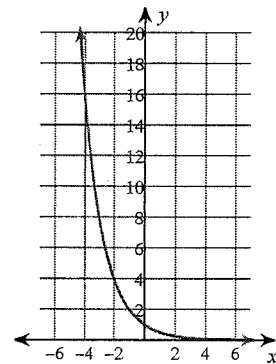
22)



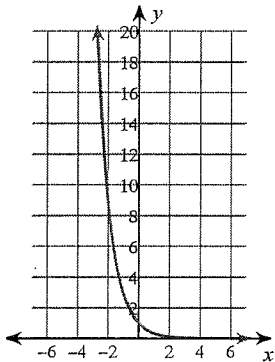
23)



24)



25)



26) 2

27) 1

28) compress horizontally by a factor of 3  
translate down 3 units

29) reflect across the x-axis  
translate down 3 units

30) shift to left by 5  
reflect across the x-axis  
shift down by 2

31) shift left 4 units

32)  $f^{-1}(x) = \frac{1-x}{x+1}$

33)  $g^{-1}(x) = -2x - 8$

34)  $\left(\frac{1}{11}\right)^2 = \frac{1}{121}$

35)  $121^{\frac{1}{2}} = 11$

36)  $15^2 = 225$

37)  $7^{-2} = \frac{1}{49}$

38)  $\log_9 \frac{1}{81} = -2$

39)  $\log_{19} x = y$

40)  $\log_{16} y = x$

41)  $\log_x 140 = y$

42)  $-3$

43) 2

44)  $\frac{1}{2}$

45)  $\frac{1}{3}$

46) 1.968

47) .340

48)  $n = -1$

49)  $m = -1$

50)  $x = \frac{\sqrt{30}}{3}, -\frac{\sqrt{30}}{3}$

51)  $x = \frac{6}{7}$

52)  $x = \frac{37}{4}$

53)  $x = 81, -81$

54)  $\log_5 (z\sqrt[3]{yx})$

55)  $\log_2 \sqrt{zyx}$

56)  $\log_7 \frac{x^2}{y^4}$

57)  $\log_5 (y^{24}x^6)$

58)  $2\log_6 u + 12\log_6 v$

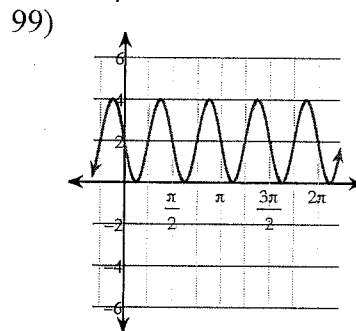
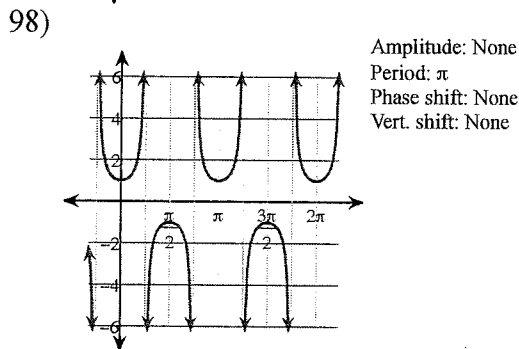
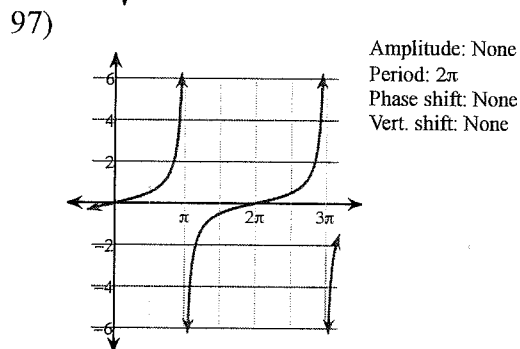
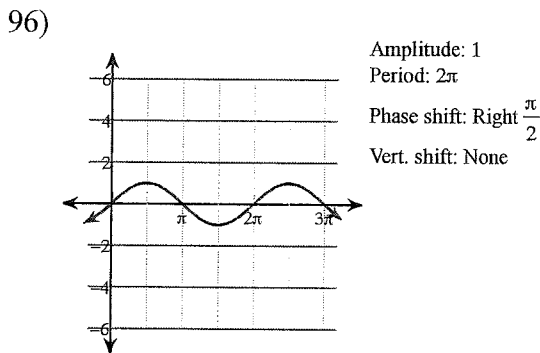
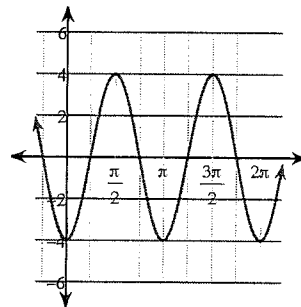
59)  $4\log_2 x + 5\log_2 y$

60)  $\log_8 a + \log_8 b + 4\log_8 c$       61)  $6\log_6 a - 30\log_6 b$       62)  $-0.3998$   
 63)  $-0.2769$       64)  $\$8,974.24$       65)  $\$17,493.65$       66)  $3.3$  years  
 67) a)  $n(t) = 18000e^{0.08t}$       68) a)  $3125$       69)  $-\frac{5\pi}{6}$       70)  $-\frac{31\pi}{18}$   
 b)  $34,137$       b)  $317,480$

71)  $\frac{5\pi}{9}$       72)  $\frac{53\pi}{36}$       73)  $745^\circ$       74)  $435^\circ$   
 75)  $200^\circ$       76)  $120^\circ$       77)  $m\angle B = 23^\circ, b = 3.4, c = 8.7$   
 78)  $m\angle B = 59.2^\circ, m\angle A = 30.8^\circ, c = 15.6$       79)  $19.6$  ft.      80)  $38.7^\circ$

81)  $\frac{24}{7}$       82)  $\frac{4\sqrt{15}}{15}$       83)  $\frac{15}{8}$       84)  $\frac{12}{13}$   
 85)  $0$       86)  $\sqrt{2}$       87)  $\frac{1}{2}$       88)  $-\frac{\sqrt{3}}{3}$

89)  $\frac{\sqrt{3}}{2}$       90)  $-\frac{1}{2}$       91)  $-2$       92)  $\frac{1}{2}$   
 93)  $-\frac{\sqrt{3}}{3}$       94)  $\frac{\sqrt{3}}{2}$       95)      Amplitude: 4  
 Period:  $\pi$   
 Phase shift: Right  $\frac{\pi}{4}$   
 Vert. shift: None



100)  $\frac{\pi}{3}$       101)  $-\frac{\pi}{6}$       102)  $\frac{\sqrt{41}}{4}$       103)  $\frac{12}{13}$   
 104)  $33^\circ$       105)  $20.9^\circ$       106)  $m\angle C = 7^\circ, a = 22.9, b = 26.9$   
 107)  $m\angle C = 130.8^\circ, m\angle A = 27.2^\circ, c = 54.6$       108) Not a triangle  
 Or  $m\angle C = 5.2^\circ, m\angle A = 152.8^\circ, c = 6.5$   
 109)  $m\angle B = 32^\circ, a = 26, b = 17$       110)  $m\angle B = 63^\circ, m\angle C = 75^\circ, m\angle A = 42^\circ$   
 111)  $m\angle B = 56^\circ, m\angle C = 47^\circ, a = 20$

$$112) \frac{\sin x + \sec x}{\sec x}$$

Decompose into sine and cosine

$$\frac{\sin x + \frac{1}{\cos x}}{\frac{1}{\cos x}}$$

Simplify

$$\sin x \cos x + 1 \quad \blacksquare$$

114) Use sum and difference formulas

116) Use pythagorean identities and reciprocal identities

$$117) \frac{\sqrt{2} - \sqrt{6}}{4}$$

$$118) \frac{\sqrt{6} - \sqrt{2}}{4}$$

$$113) \tan x + \sec x$$

Decompose into sine and cosine

$$\frac{\sin x}{\cos x} + \frac{1}{\cos x}$$

Simplify

$$\frac{\sin x + 1}{\cos x} \quad \blacksquare$$

115) use pythagorean identities

$$119) \text{ a) } \frac{24}{25}$$

$$\text{ b) } -\frac{7}{25}$$

$$\text{ c) } -\frac{24}{7}$$

$$120) \text{ a) } \frac{\sqrt{10}}{10}$$

$$\text{ b) } -\frac{3\sqrt{10}}{10}$$

$$\text{ c) } -\frac{1}{3}$$

$$121) \frac{\sqrt{2} + \sqrt{2}}{2}$$

$$122) 180^\circ n$$

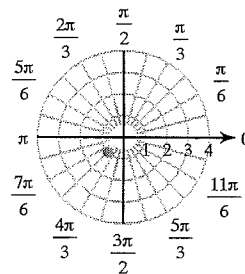
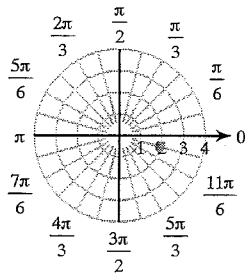
$$123) 45^\circ + 180^\circ n$$

$$124) 109.5^\circ + 360^\circ n, 250.5^\circ + 360^\circ n$$

$$125) 90^\circ + 360^\circ n$$

$$126) 60^\circ + 180^\circ n, 120^\circ + 180^\circ n \quad 127)$$

128)



$$129) \left( -\frac{3\sqrt{2}}{2}, -\frac{3\sqrt{2}}{2} \right)$$

$$130) (2\sqrt{3}, -2)$$

$$131) \left( 3, \frac{7\pi}{6} \right)$$

$$132) \left( 1, \frac{2\pi}{3} \right)$$

$$133) \cot \theta = 5$$

$$134) r = 3$$

$$135) (x+3)^2 + (y+1)^2 = 10$$

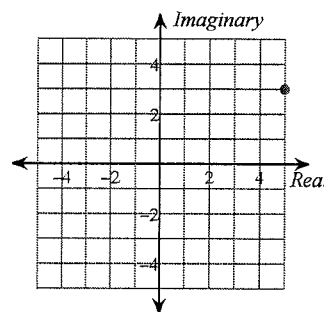
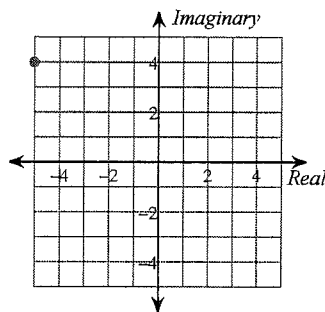
$$136) y = 4x$$

$$137) 6\sqrt{2}$$

$$138) 6$$

$$139)$$

$$140)$$



$$141) 4(\cos 270^\circ + i \sin 270^\circ)$$

$$142) 6(\cos 330^\circ + i \sin 330^\circ)$$

$$143) -64$$

$$144) -198 + 10i$$

$$145) \langle 8, 0 \rangle$$

$$146) \langle -98, -336 \rangle$$

$$147) \langle -13, -14 \rangle$$

$$148) \langle 1, -7 \rangle$$

$$149) 2\sqrt{865} \approx 58.822$$

$$150) 2\sqrt{157} \approx 25.06$$

$$151) 11$$

$$264.78^\circ$$

$$152) 20$$

$$153) 24$$

$$154) 126.87^\circ$$

$$155) 54.46^\circ$$