

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Determine whether the equation defines y as a function of x.

1) $x^2 + y = 64$ 1) _____

2) $y^2 = 6x$ 2) _____

3) $xy + 9y = 1$ 3) _____

Evaluate the function at the given value of the independent variable and simplify.

4) $f(x) = 4x^2 + 2x + 6$; $f(x - 1)$ 4) _____

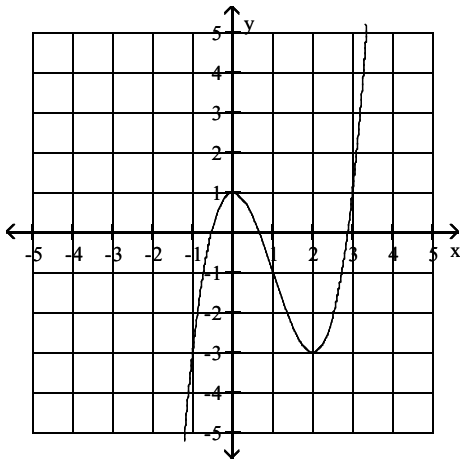
5) $f(x) = \frac{x^2 + 7}{x^3 + 2x}$; $f(5)$ 5) _____

6) $f(x) = \sqrt{x + 13}$; $f(-4)$ 6) _____

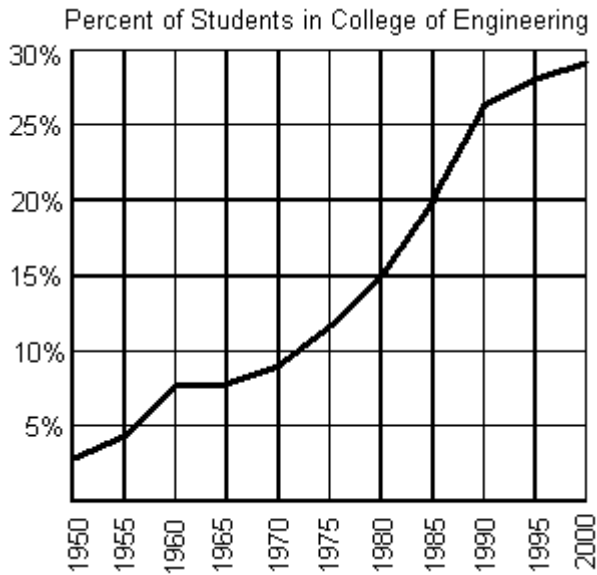
7) $h(x) = |x - 5|$; $h(15)$ 7) _____

Use the graph of the given function to find any relative maxima and relative minima.

8) $f(x) = x^3 - 3x^2 + 1$ 8) _____



The graph below shows the percentage of students enrolled in the College of Engineering at State University. Use the graph to answer the question.



9) Does the graph represent a function?

9) _____

10) If f represents the function, find $f(1965)$.

10) _____

11) If $f(x) = 20\%$, what year is represented by x ?

11) _____

12) Between what two years is the difference in function values equal to 5%?

12) _____

Evaluate the piecewise function at the given value of the independent variable.

$$13) g(x) = \begin{cases} \frac{x^2 - 6}{x + 5} & \text{if } x \neq -5 \\ x + 6 & \text{if } x = -5 \end{cases}; g(2)$$

13) _____

$$14) f(x) = \begin{cases} x + 3 & \text{if } x > -2 \\ -(x + 3) & \text{if } x \leq -2 \end{cases}; f(-6)$$

14) _____

Given functions f and g , perform the indicated operations.

$$15) f(x) = 7x - 1, \quad g(x) = 9x - 4$$

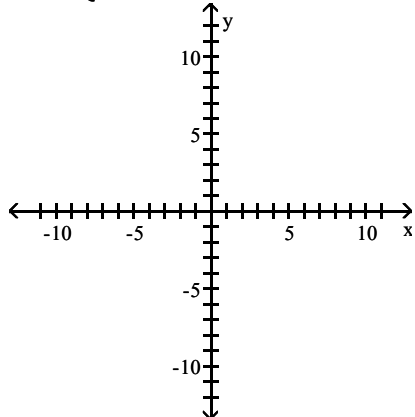
Find $f+g, f-g, fg,$

15) _____

Graph the function.

$$16) f(x) = \begin{cases} x + 5 & \text{if } -8 \leq x < 2 \\ -4 & \text{if } x = 2 \\ -x + 5 & \text{if } x > 2 \end{cases}$$

16) _____



Find functions f and g so that $h(x) = (f \circ g)(x)$.

17) $h(x) = |2x + 7|$

17) _____

18) $h(x) = \sqrt{42x^2 + 5}$

18) _____

Determine which two functions are inverses of each other.

19) $f(x) = x^3 - 4$ $g(x) = \sqrt[3]{x - 4}$ $h(x) = x^3 + 4$

19) _____

Find the inverse of the one-to-one function.

20) $f(x) = \frac{2x + 5}{7}$

20) _____

21) $f(x) = (x + 3)^3$

21) _____

22) $f(x) = \sqrt{x + 8}$

22) _____

Solve the problem.

23) You have 196 feet of fencing to enclose a rectangular region. Find the dimensions of the rectangle that maximize the enclosed area.

23) _____

24) You have 104 feet of fencing to enclose a rectangular plot that borders on a river. If you do not fence the side along the river, find the length and width of the plot that will maximize the area.

24) _____

Use the Leading Coefficient Test to determine the end behavior of the polynomial function.

25) $f(x) = 5x^3 + 5x^2 + 3x + 3$

25) _____

26) $f(x) = -5(x^2 + 3)(x + 4)^2$

26) _____

Divide using long division.

27) $(6x^2 + 17x - 45) \div (3x - 5)$ 27) _____

Divide using synthetic division.

28) $(x^5 - 4x^4 - 9x^3 + x^2 - x + 21) \div (x + 2)$ 28) _____

Solve the polynomial equation. In order to obtain the first root, use synthetic division to test the possible rational roots.

29) $x^3 + 2x^2 - 5x - 6 = 0$ 29) _____

30) $x^3 + 7x^2 + 19x + 13 = 0$ 30) _____

31) $x^3 + 7x^2 - 16x + 18 = 0$ 31) _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

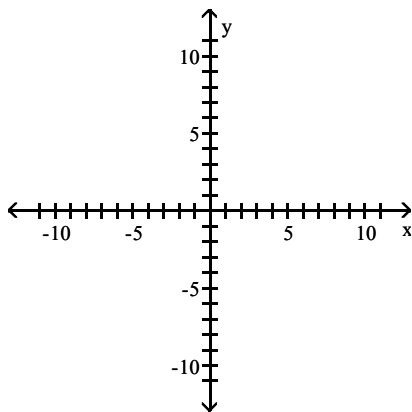
Use Descartes's Rule of Signs to determine the possible number of positive and negative real zeros for the given function.

32) $f(x) = 7x^3 - 4x^2 + x + 3.5$ 32) _____
A) 3 or 1 positive zeros, 1 negative zero B) 2 or 0 positive zeros, 1 negative zero
C) 3 or 1 positive zeros, 2 or 0 negative zeros D) 2 or 0 positive zeros, no negative zeros

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Graph the rational function.

33) $f(x) = \frac{4x^2}{x^2 - 1}$ 33) _____



MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Find the slant asymptote, if any, of the graph of the rational function.

34) $f(x) = \frac{x^2 - 3x + 2}{x + 5}$ 34) _____
A) $y = x + 5$ B) $y = x - 8$
C) $x = y + 3$ D) no slant asymptote

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Use the compound interest formulas $A = P\left(1 + \frac{r}{n}\right)^{nt}$ and $A = Pe^{rt}$ to solve.

35) Find the accumulated value of an investment of \$6000 at 8% compounded semiannually for 8 years. 35) _____

Write the equation in its equivalent exponential form.

36) $\log_b 64 = 2$ 36) _____

37) $\log_6 216 = x$ 37) _____

Write the equation in its equivalent logarithmic form.

38) $15^3 = y$ 38) _____

39) $13^x = 169$ 39) _____

Evaluate the expression without using a calculator.

40) $\log_{64} 4$ 40) _____

41) $\log_5 \frac{1}{\sqrt{5}}$ 41) _____

42) $\log_7 7^{18}$ 42) _____

Evaluate or simplify the expression without using a calculator.

43) $\log\left(\frac{1}{1000}\right)$ 43) _____

44) $\ln e$ 44) _____

Evaluate the expression without using a calculator.

45) $\ln e^{6x}$ 45) _____

Use properties of logarithms to expand the logarithmic expression as much as possible. Where possible, evaluate logarithmic expressions without using a calculator.

46) $\log_2 (8x)$ 46) _____

47) $\log_5 \left(\frac{125}{x}\right)$ 47) _____

48) $\log_6 x^7$ 48) _____

49) $\log_2 \left(\frac{x^2}{y^7}\right)$ 49) _____

50) $\log_5 \left(\frac{\sqrt{x}}{25} \right)$

50) _____

Use properties of logarithms to condense the logarithmic expression. Write the expression as a single logarithm whose coefficient is 1. Where possible, evaluate logarithmic expressions.

51) $3 \log_x 4 + \log_x 2$

51) _____

52) $5 \ln x - \frac{1}{3} \ln y$

52) _____

Solve the equation by expressing each side as a power of the same base and then equating exponents.

53) $e^x + 8 = \frac{1}{e^4}$

53) _____

Solve the exponential equation. Express the solution set in terms of natural logarithms.

54) $5^{x+7} = 3$

54) _____

55) $e^{x+4} = 2$

55) _____

Solve the logarithmic equation. Be sure to reject any value that is not in the domain of the original logarithmic expressions. Give the exact answer.

56) $\log_6 x + \log_6 (x - 35) = 2$

56) _____

57) $\log (x + 4) = \log (5x - 5)$

57) _____

Solve.

58) A fossilized leaf contains 15% of its normal amount of carbon 14. How old is the fossil (to the nearest year)? Use 5600 years as the half-life of carbon 14.

58) _____

Use Newton's Law of Cooling, $T = C + (T_0 - C)e^{kt}$, to solve the problem

59) A cup of tea with temperature 104°F is placed in a freezer with temperature 0°F. After 8 minutes, the temperature of the tea is 54.8°F. After how many minutes will its temperature be 40°F? Round your answer to the nearest minute.

59) _____

Solve the logarithmic equation. Be sure to reject any value that is not in the domain of the original logarithmic expressions. Give the exact answer.

60) $\log_4 (x - 3) = 1$

60) _____

Solve the equation by expressing each side as a power of the same base and then equating exponents.

61) $3(3^x - 6) = 27$

61) _____

Solve the problem. Round to the nearest dollar if needed.

62) To save for retirement, you decide to deposit \$2250 into an IRA at the end of each year for the next 35 years. If the interest rate is 5% per year compounded annually, find the value of the IRA after 35 years.

62) _____

Use periodic properties of the trigonometric functions to find the exact value of the expression.

63) $\cos \frac{10\pi}{3}$ 63) _____

64) $\sin \frac{17\pi}{3}$ 64) _____

65) $\cot \left(-\frac{\pi}{3} \right)$ 65) _____

Sin t and cos t are given. Use identities to find the indicated value. Where necessary, rationalize denominators.

66) $\sin t = \frac{\sqrt{7}}{4}$, $\cos t = \frac{3}{4}$. Find sec t. 66) _____

$0 < t < \frac{\pi}{2}$ and cos t is given. Use the Pythagorean identity $\sin^2 t + \cos^2 t = 1$ to find sin t.

67) $\cos t = \frac{\sqrt{14}}{4}$ 67) _____

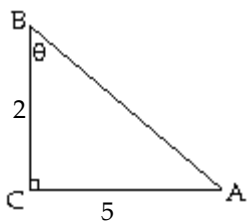
Find a cofunction with the same value as the given expression.

68) $\sin \frac{\pi}{19}$ 68) _____

69) $\csc 52^\circ$ 69) _____

Find all six trig functions for the angle θ .

70) 70) _____



A point on the terminal side of angle θ is given. Find the exact value of the six trigonometric functions of θ .

71) (2, -3) Find sin θ . 71) _____

Solve the problem.

72) A straight trail with a uniform inclination of 16° leads from a lodge at an elevation of 500 feet to a mountain lake at an elevation of 8300 feet. What is the length of the trail (to the nearest foot)? 72) _____

73) A building 200 feet tall casts a 90 foot long shadow. If a person looks down from the top of the building, what is the measure of the angle of depression from the top of the building (round to the nearest degree)? (Assume the person's eyes are level with the top of the building.) 73) _____

Find the exact value of the indicated trigonometric function of θ .

74) $\sin \theta = -\frac{2}{3}$, $\tan \theta > 0$ Find $\sec \theta$.

74) _____

75) $\cot \theta = -\frac{9}{4}$, $\cos \theta < 0$ Find $\csc \theta$.

75) _____

Use reference angles to find the exact value of the expression. Do not use a calculator.

76) $\sin \frac{4\pi}{3}$

76) _____

77) $\sec \frac{-5\pi}{4}$

77) _____

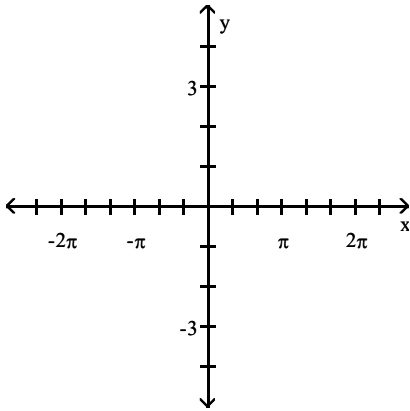
78) $\csc 660^\circ$

78) _____

Graph the function.

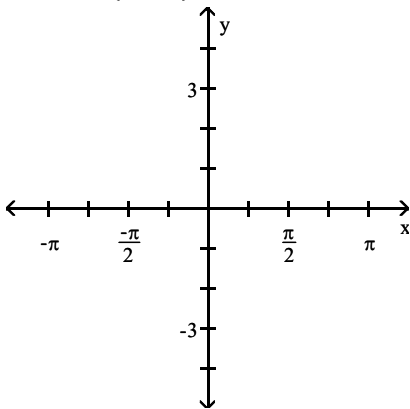
79) $y = 3 \sin 3x$

79) _____



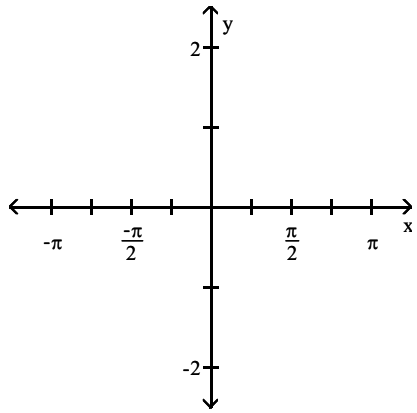
80) $y = 3 \sin \left(x + \frac{\pi}{4} \right)$

80) _____



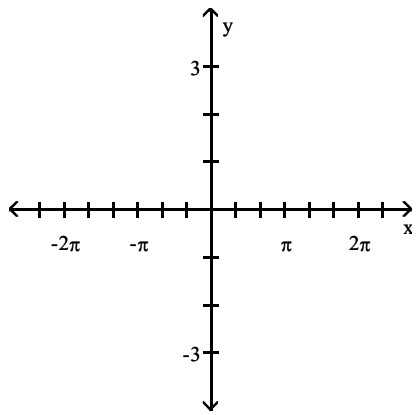
81) $y = \frac{1}{3} \sin(x + \pi)$

81) _____



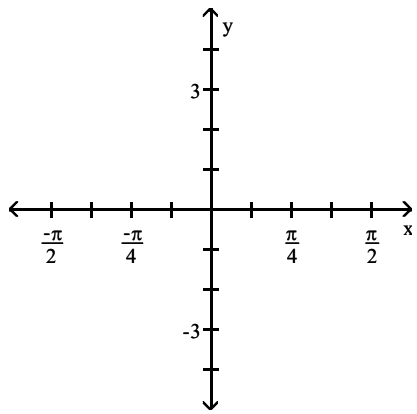
82) $y = 3 \cos \frac{1}{2}x$

82) _____

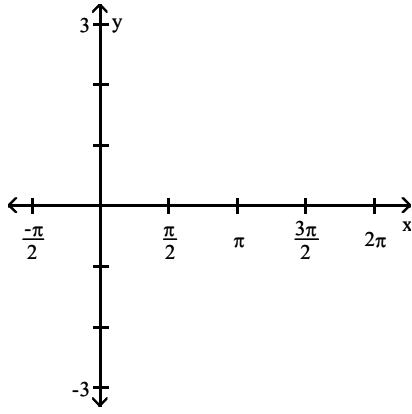


83) $y = -3 \cos(3x - \pi)$

83) _____

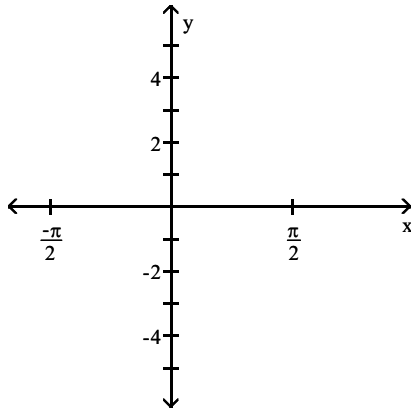


84) $y = -\tan(x - \pi)$



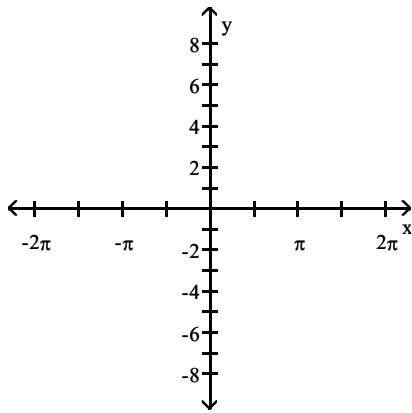
84) _____

85) $y = 4 \cot 3x$



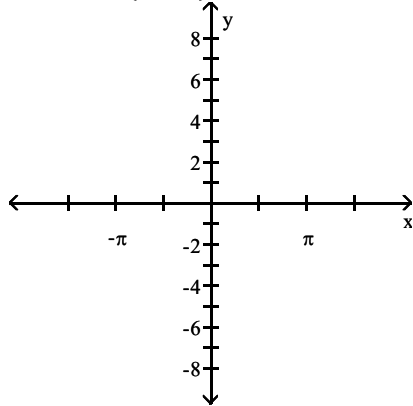
85) _____

86) $y = 3 \sec x$



86) _____

$$87) y = -4 \csc \left(x + \frac{\pi}{4} \right)$$



87) _____

Find the exact value of the expression.

$$88) \sin^{-1} \frac{\sqrt{3}}{2}$$

88) _____

$$89) \cos^{-1} \left(-\frac{\sqrt{2}}{2} \right)$$

89) _____

$$90) \cos^{-1} (1)$$

90) _____

$$91) \tan^{-1} \frac{\sqrt{3}}{3}$$

91) _____

Find the exact value of the expression, if possible. Do not use a calculator.

$$92) \tan^{-1} \left[\tan \left(\frac{3\pi}{5} \right) \right]$$

92) _____

Use a sketch to find the exact value of the expression.

$$93) \cot \left(\sin^{-1} \frac{5\sqrt{61}}{61} \right)$$

93) _____

$$94) \cot \left(\sin^{-1} \frac{\sqrt{2}}{2} \right)$$

94) _____

Use a right triangle to write the expression as an algebraic expression. Assume that x is positive and in the domain of the given inverse trigonometric function.

$$95) \cos(\tan^{-1} x)$$

95) _____

$$96) \sin(\sec^{-1} \frac{\sqrt{x^2 + 9}}{x})$$

96) _____

Use a sketch to find the exact value of the expression.

97) $\cos\left(\sin^{-1}\frac{3}{5}\right)$

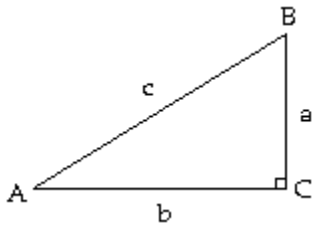
97) _____

Find the exact value of the expression, if possible. Do not use a calculator.

98) $\sin^{-1}\left[\sin\left(\frac{4\pi}{7}\right)\right]$

98) _____

Solve the right triangle shown in the figure. Round lengths to one decimal place and express angles to the nearest tenth of degree.



99) $a = 3.8$ cm, $b = 2.4$ cm

99) _____

100) $a = 3.3$ in, $A = 55.1^\circ$

100) _____

Using a calculator, solve the following problems. Round your answers to the nearest tenth.

101) A ship is 50 miles west and 31 miles south of a harbor. What bearing should the captain set to sail directly to harbor?

101) _____

102) A boat leaves the entrance of a harbor and travels 16 miles on a bearing of N 22° E. How many miles north and how many miles east from the harbor has the boat traveled?

102) _____

Two sides and an angle (SSA) of a triangle are given. Determine whether the given measurements produce one triangle, two triangles, or no triangle at all. Solve each triangle that results. Round lengths to the nearest tenth and angle measures to the nearest degree.

103) $B = 13^\circ$, $b = 4.3$, $a = 6.37$

103) _____

Polar coordinates of a point are given. Find the rectangular coordinates of the point.

104) $(-3, 120^\circ)$

104) _____

The rectangular coordinates of a point are given. Find polar coordinates of the point. Express θ in radians.

105) $(2\sqrt{3}, 2)$

105) _____

Convert the rectangular equation to a polar equation that expresses r in terms of θ .

106) $(x - 16)^2 + y^2 = 256$

106) _____

Convert the polar equation to a rectangular equation.

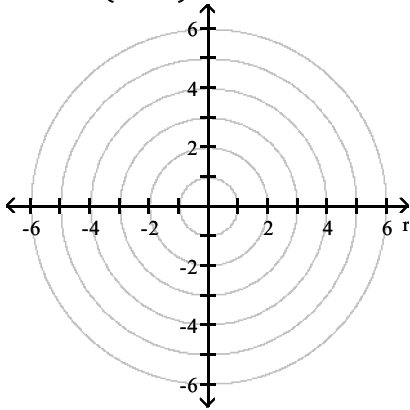
107) $r = 4 \csc \theta$

107) _____

Use a graphing utility to graph the polar equation.

108) $r = 6 \sin\left(\theta - \frac{\pi}{4}\right)$

108) _____



Write the complex number in polar form. Express the argument in degrees.

109) $-6 + 8i$

109) _____

Write the complex number in rectangular form.

110) $3\left(\cos \frac{3\pi}{4} + i \sin \frac{3\pi}{4}\right)$

110) _____

Find the product of the complex numbers. Leave answer in polar form.

111) $z_1 = 5(\cos 20^\circ + i \sin 20^\circ)$

$z_2 = 4(\cos 10^\circ + i \sin 10^\circ)$

111) _____

Find the quotient $\frac{z_1}{z_2}$ of the complex numbers. Leave answer in polar form.

112) $z_1 = 5(\cos 200^\circ + i \sin 200^\circ)$

$z_2 = 4(\cos 50^\circ + i \sin 50^\circ)$

112) _____

Use DeMoivre's Theorem to find the indicated power of the complex number. Write the answer in rectangular form.

113) $\left[10 \left(\cos \frac{3\pi}{4} + i \sin \frac{3\pi}{4}\right)\right]^3$

113) _____

Find the specified vector or scalar.

114) $\mathbf{u} = -12\mathbf{i} - 2\mathbf{j}$, $\mathbf{v} = 6\mathbf{i} + 7\mathbf{j}$; Find $\mathbf{u} - \mathbf{v}$.

114) _____

115) $\mathbf{v} = 10\mathbf{i} + 4\mathbf{j}$; Find $\|-7\mathbf{v}\|$.

115) _____

Find the unit vector that has the same direction as the vector \mathbf{v} .

116) $\mathbf{v} = 3\mathbf{i} - 4\mathbf{j}$

116) _____

Write the vector \mathbf{v} in terms of \mathbf{i} and \mathbf{j} whose magnitude $\|\mathbf{v}\|$ and direction angle θ are given.

117) $\|\mathbf{v}\| = 7$, $\theta = 225^\circ$

117) _____

Find the angle between the given vectors. Round to the nearest tenth of a degree.

118) $\mathbf{u} = \mathbf{i} - \mathbf{j}$, $\mathbf{v} = 4\mathbf{i} + 5\mathbf{j}$

118) _____

Find $\text{proj}_{\mathbf{w}}\mathbf{v}$.

119) $\mathbf{v} = -3\mathbf{i} - 3\mathbf{j}$; $\mathbf{w} = 3\mathbf{i} + \mathbf{j}$

119) _____

Solve the problem.

120) Two forces, \mathbf{F}_1 and \mathbf{F}_2 , of magnitude 60 and 70 pounds, respectively, act on an object. The direction of \mathbf{F}_1 is $\text{N}40^\circ\text{E}$ and the direction of \mathbf{F}_2 is $\text{N}40^\circ\text{W}$. Find the magnitude and the direction angle of the resultant force. Express the direction angle to the nearest tenth of a degree.

120) _____