Math 1720 Final Exam REVIEW
Show All work!

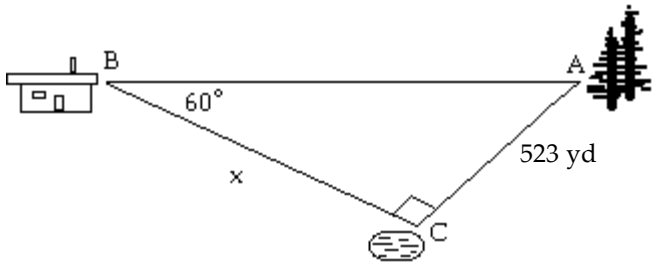
The Final Exam will contain problems/questions that fit into these Course Outcomes (stated on the course syllabus):

Upon completion of this course, students will:

1. Solve problems using mathematics, and determine if solutions are reasonable.
   Solve trigonometric equations, solve triangles, and evaluate inverse trigonometric functions and determine if the solution/result is reasonable.
2. Apply mathematical concepts to solve real-life problems using formulas (deduction) and interpret the meaning of the solution.
   Create, analyze, and interpret results for applications involving vectors, linear and angular speed, navigation, the periodic nature of the trigonometric functions, and the conic sections.
3. Construct meaningful connections (transfer of knowledge) between mathematics and other disciplines.
4. Apply technology for mathematical reasoning and problem solving.
   Apply mathematical reasoning with technology to solve problems involving trigonometric functions and inverse trigonometric functions.
5. Analyze data/graphs by using mathematical modeling and/or statistical reasoning.
   Use modeling to determine information involving graphs of the conic sections, and approximating solutions to trigonometric equations.

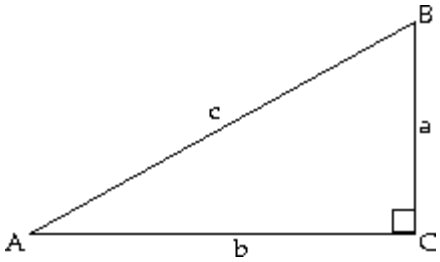
Solve the problem.

1) The path between three landmarks in a national park form a right triangle. The oldest living evergreen tree is at point A, the ranger station is at point B, and the natural hotspring is at point C. The right angle is at point C, and there is a 60° angle at point B. If the distance between the hotspring and the evergreen tree is523 yards, find the distance, x, from the hotspring to the ranger station.



A) 301.95 yd B) 739.63 yd C) 905.86 yd D) 369.8168 yd

Solve the right triangle.



2) a = 17.4, c = 20.5

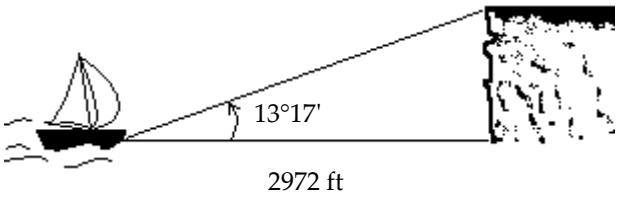
A) A = 58.1, B = 31.9, b = 26.9
B) A = 58.1, B = 31.9, b = 10.8
C) A = 58.1, B = 58.1, b = 10.8
D) A = 49.7, B = 40.3, b = 26.9

3) A = 31°, b = 58.3

A) B = 31°, a = 97, c = 50
B) B = 59°, a = 97, c = 113.2
C) B = 59°, a = 35, c = 68
D) B = 31°, a = 50, c = 35

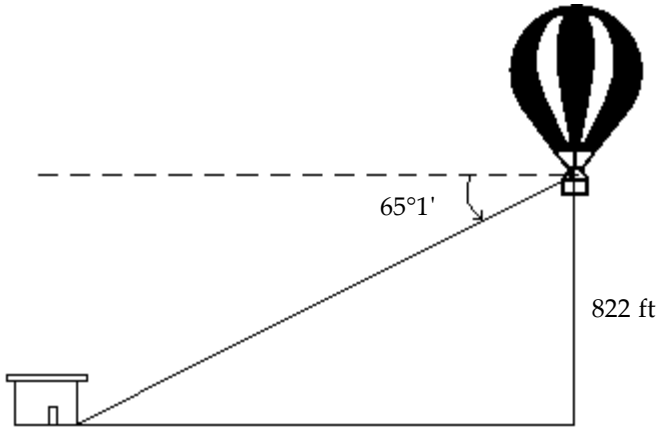
Solve.

4) From a boat on the lake, the angle of elevation to the top of a cliff is 13°17'. If the base of the cliff is 2972 feet from the boat, how high is the cliff (to the nearest foot)?



A) 712 ft
B) 705 ft
C) 702 ft
D) 715 ft

5) From a balloon 822 feet high, the angle of depression to the ranger headquarters is 65°1'. How far is the headquarters from a point on the ground directly below the balloon (to the nearest foot)?



A) 373 ft
B) 388 ft
C) 378 ft
D) 383 ft

Find the trigonometric function value of angle θ.

6) $\cos\theta = \frac{2}{9}$ and θ in quadrant IV

Find sin θ.

A) $-\frac{\sqrt{77}}{9}$
B) $-\frac{\sqrt{77}}{2}$
C) $-\sqrt{77}$
D) $-\frac{9}{2}$

7) $\sin\theta = -\frac{3}{11}$ and θ in quadrant III

Find sec θ.

A) $-\frac{3\sqrt{7}}{28}$
B) $-\frac{11\sqrt{7}}{28}$
C) $\frac{\sqrt{11}}{3}$
D) $-\frac{11\sqrt{7}}{11}$

Use a calculator to find all nonnegative angle(s) less than 360° for the function value.

8) sin θ = 0.9613

A) 74°, 106°
B) 16°, 286°
C) 1°, 179°
D) 254°

Solve.

9) An airplane travels at 125 km/h for 3 hr in a direction of 349° from St. Louis. At the end of this time, how far west of St. Louis is the plane (to the nearest kilometer)?

A) 72 B) 1965 C) 1929 D) 368

10) A pulley rotates through 58° in one minute. How many rotations does the pulley make in an hour?

A) 19.3 rotations B) 174.0 rotations C) 9.7 rotations D) 348.0 rotations

11) A car wheel has a 15–inch radius. Through what angle (to the nearest tenth of a degree) does the wheel turn when the car rolls forward 5 ft?

A) 234.2° B) 239.2° C) 229.2° D) 244.2°

12) A wheel is rotating at 3 radians/sec, and the wheel has a 81–inch diameter. To the nearest foot per minute, what is the linear speed of a point on the rim?

A) 598 ft/min B) 603 ft/min C) 608 ft/min D) 613 ft/min

Find the amplitude, period or phase shift.

13) Find the amplitude of $y = -2 \cos\left(4x + \frac{\pi}{2}\right)$.

A) 4 B) $\frac{\pi}{2}$ C) 2 D) –8

14) Find the period of $y = -2 \cos\left(3x + \frac{\pi}{2}\right)$.

A) $\frac{\pi}{2}$ B) $\frac{2\pi}{3}$ C) π D) 2

15) Find the phase shift of $y = -4 - 2\sin\left(4x + \frac{\pi}{6}\right)$.

A) $\frac{\pi}{24}$ to the right B) $\frac{\pi}{6}$ to the left C) $\frac{\pi}{24}$ to the left D) $\frac{\pi}{12}$ to the right

Solve.

16) The monthly average high temperature T in Winston–Salem during the period from May to September can be approximated using

$T(t) = 81.6 + 5.4 \sin(1.47t - 9.60)$,

where t is the month (t = 1 corresponds to January) and T is the monthly average high temperature in degrees Fahrenheit. What is the maximum average high temperature, and during which month does it occur?

A) 86.1° F during July B) 81.6° F during August
C) 87.0° F during August D) 87.0° F during July

17) The voltage E in an electrical circuit is given by $E = 4.8 \cos 110\pi t$, where t is time measured in seconds. Find the period.

A) 55 seconds B) 55π seconds C) $\frac{1}{55}$ seconds D) $\frac{\pi}{55}$ seconds

18) The total sales in dollars of some small businesses fluctuates according to the equation $S = A + B \sin \pi x/6$, where x is the time in months, with $x = 1$ corresponding to January, $A = 7900$, and $B = 4700$. Determine the month with the greatest total sales and give the sales in that month.

A) during June; \$7900
B) during September; \$3200
C) during December; \$12,600
D) during March; \$12,600

Find the exact value of the expression using the provided information.

19) Find $\cos(\theta + \phi)$ given that $\cos\theta = \frac{5}{13}$ and $\cos\phi = \frac{4}{5}$ and that θ and ϕ are between 0 and $\pi/2$.

A) $-\frac{16}{65}$ B) $-\frac{33}{65}$ C) $\frac{63}{65}$ D) $\frac{56}{65}$

Find the exact value.

20) Given that $\sin\theta = -\frac{4}{5}$ with θ in quadrant IV, find $\sin 2\theta$.

A) $\frac{24}{25}$ B) $\frac{7}{25}$ C) $-\frac{7}{25}$ D) $-\frac{24}{25}$

Find the exact value in radians.

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

A) $-\frac{\pi}{6}$ B) $\frac{\pi}{6}$ C) $\frac{\pi}{3}$ D) $\frac{2\pi}{3}$

22) $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$

A) $\frac{\pi}{3}$ B) $\frac{\pi}{6}$ C) π D) $\frac{4\pi}{3}$

Solve the equation for the interval $[0, 2\pi)$.

23) $\cos^2 x + 2\cos x + 1 = 0$

A) $\frac{\pi}{2}, \frac{3\pi}{2}$ B) 2π C) π D) $\frac{\pi}{4}, \frac{7\pi}{4}$

24) $\sec^2 x - 2 = \tan^2 x$

A) $\frac{\pi}{3}$ B) $\frac{\pi}{4}$ C) No solution D) $\frac{\pi}{6}$

25) $4\sin^2 x = 4\cos x + 1$

A) $\frac{\pi}{3}, \frac{2\pi}{3}$ B) $\frac{\pi}{3}, \frac{5\pi}{3}$ C) No solution D) $\frac{\pi}{3}, \frac{4\pi}{3}$

Solve the equation in the interval $[0°, 360°)$.

26) $4\sin^2\theta = 3$

A) 60°, 120°
B) 240°, 300°
C) 60°, 120°, 240°, 300°
D) No solution

27) $\sin^2\theta - \sin\theta - 12 = 0$

A) No solution B) 45° C) 45°, 315° D) 45°, 135°

Solve the equation, finding all solutions in [0°, 360°). Round to nearest hundredth when necessary.

28) $10\cos^2 x + 7\cos x + 1 = 0$

A) 101.54° , 258.46° , 120° , 240°

B) 78.46° , 281.54° , 78.46° , 300°

C) 168.46° , 191.54° , 150° , 210°

D) 78.46° , 281.54° , 120° , 240°

29) $\sec^2 x + 3\tan x = 11$

A) 63.43° , 243.43° , 78.69° , 258.69°

B) 116.57° , 296.57° , 78.69° , 258.69°

C) 63.43° , 243.43° , 101.31° , 281.31°

D) 116.57° , 296.57° , 101.31° , 281.31°

Solve.

30) The weekly sales in thousands of items of a product has a seasonal sales record approximated by

$n = 81.43 + 18.8 \sin \frac{\pi t}{24}$

(t = time in weeks with t = 1 referring to the first week in the year). During which week(s) will the sales equal 90,830 items?

A) Week 4 and week 47 B) Week 30 and week 47

C) Week 21 and week 30 D) Week 4, week 20, and week 52

31) A coil of wire rotating in a magnetic field induces a voltage given by $e = 20 \sin\left(\frac{\pi t}{4} - \frac{\pi}{2}\right)$, where t is time in seconds. Find the smallest positive time to produce a voltage of $10\sqrt{3}$.

A) 3.33π sec B) 3 sec C) 3.33 sec D) 3π sec

Solve the triangle, if possible. Round to the nearest hundredth.

32) B = 52.8° C = 114.6° b = 10.13

A) A = 10.6°, a = 13.56, c = 4.77 B) A = 12.6°, a = 2.77, c = 11.56

C) A = 12.6°, a = 4.77, c = 13.56 D) A = 10.6°, a = 11.56, c = 2.77

33) B = 17.4° b = 5.97 a = 6.65

A) A = 19.46°, C = 2.06°, c = 0.72 B) A' = 160.54°, C' = 2.06°, c' = 0.72

C) A = 19.46°, C = 143.14°, c = 11.98 D) No solution

34) A = 65.3° a = 2.15 km b = 2.25 km

A) B = 42.8°, C = 71.9°, c = 1.61 km or B = 6.6°, C = 108.1°, c = 0.27 km

B) B = 71.9°, C = 42.8°, c = 1.61 km or B = 108.1°, C = 6.6°, c = 0.27 km

C) B = 71.9°, C = 42.8°, c = 1.61 km D) No solution

Solve.

35) To find the distance AB across a river, a distance BC of 241 m is laid off on one side of the river. It is found that B = 108.6° and C = 14.9°. Find AB. Round to the nearest meter.

A) 77 m B) 74 m C) 62 m D) 59 m

36) Lookout station B is located 8 mi due east of station A. The bearing of a fire from A is S12°50'W and the bearing from B is S35°50'W. Determine the distance from the fire to B to the nearest tenth of a mile.

A) 22.0 mi B) 20.0 mi C) 12.0 mi D) 10.0 mi

37) A boat leaves the dock and sails in a direction of 70°. Once reaching this destination on the opposite shore, it sails in a direction of 272° and docks 150 km due north of its original starting position. The boat then sails due south and returns to its original starting postion. What is the total distance the boat has traveled?

A) 626 km B) 926 km C) 776 km D) 997 km

Solve the triangle, if possible. Round to the nearest hundredth.

38) a = 7.6 b = 13.7 c = 16.8

A) A = 28.44°, B = 51.38°, C = 100.18°
B) A = 26.44°, B = 53.38°, C = 100.18°
C) A = 24.44°, B = 53.38°, C = 102.18°
D) No solution

39) C = 118.3° a = 7.70 km b = 8.78 km

A) c = 14.16 km, A = 28.61°, B = 33.09°
B) c = 19.96 km, A = 26.61°, B = 35.09°
C) c = 17.06 km, A = 30.61°, B = 31.09°
D) No solution

40) a = 7 ft b = 7 ft c = 16 ft

A) A = 81.79°, B = 81.79°, C = 16.43°
B) A = 86.79°, B = 86.79°, C = 6.43°
C) A = 81.79°, B = 16.43°, C = 81.79°
D) No solution

Solve.

41) Two ships leave a harbor together traveling on courses that have an angle of 130° between them. If they each travel 538 miles, how far apart are they to the nearest mile?

A) 455 mi B) 975 mi C) 1950 mi D) 42 mi

42) Two cars leave the same place at the same time. The first drives in a straight line N35°W at 30 miles per hour and the second drives in a straight line N12°E at 40 miles per hour. After 1 hour, how far apart are the cars to the nearest mile?

A) 29 mi B) 42 mi C) 64 mi D) 20 mi

43) An airplane leaves an airport and flies due south 120 miles and then 170 miles in the direction (bearing) of 190°40'. Assuming the earth is flat, how far is the plane from the airport at this time to the nearest mile?

A) 268 mi B) 258 mi C) 279 mi D) 289 mi

44) Two forces of 415 newtons and 200 newtons act at a point. The resultant force is 486 newtons. Find the angle between the forces.

A) 98.3° B) 71.7° C) 165.9° D) 81.7°

45) A hot–air balloon is rising vertically 10 ft/sec while the wind is blowing horizontally at 5 ft/sec. Find the angle that the balloon makes with the horizontal.

A) 26.6° B) 63.4° C) 50.3° D) 52.1°

46) An airplane takes off at a speed **S** of 295 mph at an angle of 17° with the horizontal. Resolve the vector **S** into components.

A) Horizontal: 86.2 mph, vertical: 282.1 mph
B) Horizontal: 282.1 mph, vertical: 86.2 mph
C) Horizontal: 308.5 mph, vertical: 1009 mph
D) Horizontal: 1009 mph, vertical: 308.5 mph

47) A hot–air balloon exerts a 1150 lb pull **B** on a tether line at a 55° angle with the horizontal. Resolve the vector **B** into components.

A) Horizontal: 1403.9 lb, vertical: 2005 lb
B) Horizontal: 659.6 lb, vertical: 942 lb
C) Horizontal: 2005 lb, vertical: 1403.9 lb
D) Horizontal: 942 lb, vertical: 659.6 lb

Find the magnitude of the vector.

48) $\mathbf{u} = \langle -5, 4 \rangle$

A) $\frac{9}{2}$ B) 3 C) 41 D) $\sqrt{41}$

Perform the indicated operation.

49) $\mathbf{u} = \langle -8, 3 \rangle$, $\mathbf{v} = \langle -8, 5 \rangle$

$3\mathbf{u} + 4\mathbf{v}$

A) $\langle -32, 14 \rangle$ B) $\langle -15, -12 \rangle$ C) $\langle -16, 8 \rangle$ D) $\langle -56, 29 \rangle$

Find the dot product, $\mathbf{u} \cdot \mathbf{v}$, for the given vectors.

50) $\mathbf{u} = \langle 10, -12 \rangle$, $\mathbf{v} = \langle 6, 4 \rangle$

A) −96 B) −32 C) 12 D) 108

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

51) $\mathbf{t} = \langle -4, -1 \rangle$, $\mathbf{s} = \langle 3, 2 \rangle$

A) 132.3° B) −70.3° C) 160.3° D) 19.7°

Find an equation of a parabola satisfying the given conditions.

52) Focus at (5, 0), directrix $x = -5$

A) $y = \frac{1}{20}x^2$ B) $-20y = x^2$ C) $x = \frac{1}{20}y^2$ D) $y^2 = -20x$

53) Focus at (−2, −3), directrix $y = 7$

A) $(y + 2)^2 = -20(x - 2)$ B) $(y + 2)^2 = -20(x + 2)$

C) $(x + 2)^2 = -20(y + 2)$ D) $(x + 2)^2 = -20(y - 2)$

Find the vertex, the focus, and the directrix of the parabola.

54) $(x + 5)^2 = -20(y - 3)$

A) V: (−5,3); F: (−5, −2); D: $y = 8$ B) V: (−5,4); F: (−5, −2); D: $y = 8$

C) V: (−5,3); F: (−10,−2); D: $y = 8$ D) V: (3,−5); F: (−5, −2); D: $y = 8$

55) $(y - 5)^2 = -4(x + 2)$

A) V: (−1,5); F: (−3, 5); D: $x = -1$ B) V: (−2,5); F: (−3, 5); D: $x = -2$

C) V: (−2,5); F: (−3, 5); D: $x = -1$ D) V: (−2,5); F: (−3, 4); D: $x = -1$

Solve the problem.

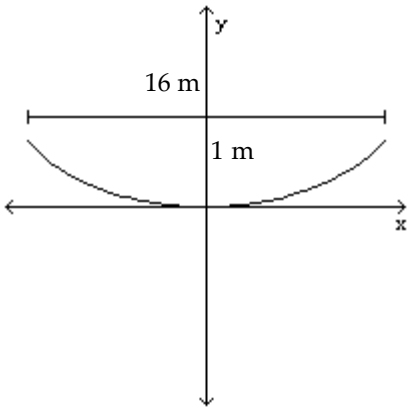
56) A cross−section of an irrigation canal is a parabola. If the surface of the water is 40 feet wide and the canal is 35 feet deep at the center, how deep is it 10 feet from the edge?

A) 26.2 ft B) 19.7 ft C) 15.3 ft D) 8.8 ft

57) A searchlight has a parabolic cross section with its light source at the focus. If the light source is located 5 feet from the base along the axis of symmetry and the opening is 14 feet across, how deep should the searchlight be?

A) 2.5 ft B) 12.3 ft C) 9.8 ft D) 0.9 ft

58) A radio telescope has a parabolic surface. If it is 1 meters deep and 16 meters wide, how far is the focus from the vertex?



A) 4 m B) 16 m C) 1 m D) 64 m

Find the center and the radius of the circle.

59) $x^2 + y^2 + 12x - 12y + 72 = 9$

A) (6, –6); r = 3 B) (–6, 6); r = 3 C) (6, –6); r = 9 D) (–6, 6); r = 9

Find an equation of an ellipse satisfying the given conditions.

60) Foci at (–2, 0), (2, 0); vertices at (–3, 0), (3, 0)

A) $\frac{x^2}{4} + \frac{y^2}{5} = 1$ B) $\frac{x^2}{5} + \frac{y^2}{9} = 1$ C) $\frac{x^2}{9} + \frac{y^2}{5} = 1$ D) $\frac{x^2}{4} + \frac{y^2}{9} = 1$

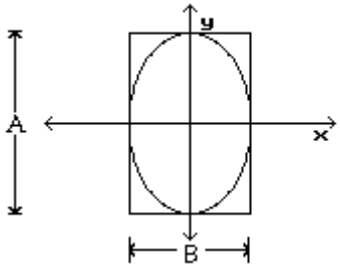
61) Vertices: (–12, 0) and (12, 0); length of minor axis: 20

A) $\frac{x^2}{144} + \frac{y^2}{200} = 1$ B) $\frac{x^2}{100} + \frac{y^2}{144} = 1$ C) $\frac{x^2}{288} + \frac{y^2}{100} = 1$ D) $\frac{x^2}{144} + \frac{y^2}{100} = 1$

Solve.

62) An elliptical riding path is to be built on a rectangular piece of property that measures 6 mi by 4 mi. Find an equation for the ellipse if the path is to touch the center of the property line on all 4 sides. Notice the center of the ellipse is located at the exact center of the property, and that east/west of the center is along the 'x-axis' and north/south is along the 'y–axis'.

A = 6 mi
B = 4 mi



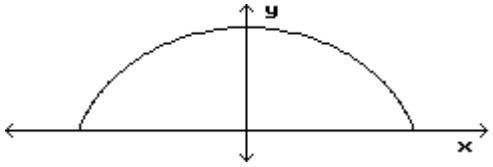
A) $\frac{x^2}{4} + \frac{y^2}{9} = 1$ B) $\frac{x^2}{36} + \frac{y^2}{4} = 1$ C) $\frac{x^2}{9} + \frac{y^2}{4} = 1$ D) $\frac{x^2}{4} + \frac{y^2}{36} = 1$

63) Using the information from #62, if someone is on the riding path and is located exactly one mile east from the center of the property, how far north (or south) would that person be located from the center (to two decimal places)?

A) 2.60 miles B) 1.97 miles C) 1.89 miles D) 2.83 miles

Solve.

64) A railroad tunnel is shaped like a semi–ellipse. The height of the tunnel at the center is 46 ft and the vertical clearance must be 23 ft at a point 12 ft from the center. Find an equation for the ellipse.



A) $\frac{x^2}{144} + \frac{y^2}{2116} = 1$ B) $\frac{x^2}{192} + \frac{y^2}{529} = 1$ C) $\frac{x^2}{192} + \frac{y^2}{2116} = 1$ D) $\frac{x^2}{2116} + \frac{y^2}{192} = 1$

Find the equation of the hyperbola satisfying the given conditions.

65) Vertices at (0, 3) and (0, –3); foci at (0, 9) and (0, –9)

A) $\frac{y^2}{81} - \frac{x^2}{9} = 1$ B) $\frac{y^2}{9} - \frac{x^2}{72} = 1$ C) $\frac{y^2}{9} - \frac{x^2}{81} = 1$ D) $\frac{y^2}{72} - \frac{x^2}{9} = 1$

Find the vertices of the hyperbola.

66) $36y^2 - 4x^2 = 144$

A) (–6, 0), (6, 0) B) (0, 2), (0, –2) C) (0, 6), (0, –6) D) (–2, 0), (2, 0)

Find the foci of the given hyperbola.

67) $\frac{x^2}{144} - \frac{y^2}{64} = 1$

A) (–12, 0), (12, 0)
B) (0, –8), (0, 8)
C) $(0, -4\sqrt{13})$, $(0, 4\sqrt{13})$
D) $(-4\sqrt{13}, 0)$, $(4\sqrt{13}, 0)$

Find the asymptotes of the hyperbola.

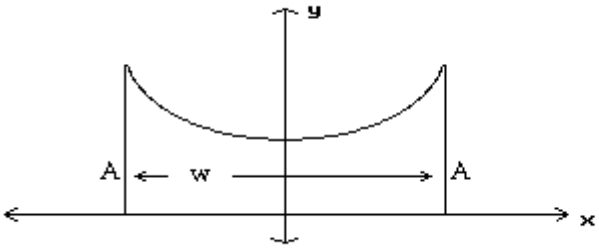
68) $9y^2 - 25x^2 = 225$

A) $y = \frac{3}{5}x$ and $y = -\frac{3}{5}x$
B) $y = \frac{25}{9}x$ and $y = -\frac{25}{9}x$
C) $y = \frac{5}{3}x$ and $y = -\frac{5}{3}x$
D) $y = \frac{9}{25}x$ and $y = -\frac{9}{25}x$

Solve.

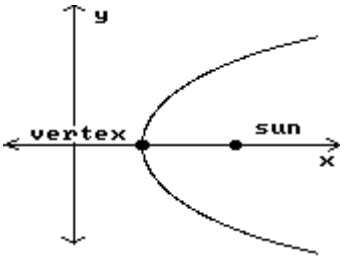
69) The roof of a building is in the shape of the hyperbola $y^2 - x^2 = 52$, where x and y are in meters. Determine the distance, w, between the outside walls.

A = 8 m



A) 12 m B) 10.8 m C) 3.45 m D) 6.9 m

70) A comet follows the hyperbolic path described by $\frac{x^2}{10} - \frac{y^2}{21} = 1$, where x and y are in millions of miles. If the sun is the focus of the path, how close to the sun is the vertex of the path?



A) 3.2 million mi B) 2.4 million mi C) 31 million mi D) 7.2 million mi

Answer Key
Testname: FINAL EXAM REVIEW

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

Answer Key
Testname: FINAL EXAM REVIEW

55) C
56) A
57) A
58) B
59) B
60) C
61) D
62) A
63) A
64) C
65) B
66) B
67) D
68) C
69) D
70) B