Multiple Choice Section

1. (specs-01)

The point $(m,\ n)$ is the point of intersection of the terminal arm of angle θ in standard position and the unit circle centered at $(0,\ 0)$. Determine the value of $\sin\theta$.

A. m

B. n

C. $\frac{m+n}{2}$

D. $\frac{m-n}{2}$

2. (specs-02)

Determine the period of $y = \sin\frac{2\pi}{3}(x-6)$.

A. 3
B. 6
C. 3π
D. 4π

3. (specs-03)

Convert 183° to radians.

A. 3.19
B. 6.33
C. 0.32
D. 2.58

4. (specs-04)

Solve: $1+2\sin x = 0\ ,\ 0 \le x < 2\pi$ Give exact solution(s).

A. $-\frac{\pi}{6}$

B. $\frac{2\pi}{3},\ \frac{5\pi}{3}$

C. $\frac{2\pi}{3},\ -\frac{\pi}{3}$

D. $\frac{7\pi}{6},\ \frac{11\pi}{6}$

5. (specs-07)

At a seaport, the depth of the water, d, in metres, at time t hours, during a certain day is given by:

$$d = 3.4\sin 2\pi\frac{(t-7.00)}{10.6} + 2.8$$

On that day, determine the depth of the water at 6:30 p.m.

A. 1.39 m
B. 1.81 m
C. 2.80 m
D. 4.53 m

6. (specs-05)

Determine the range of the function $y = 6\cos\frac{1}{2}(x-3)+4$.

A. $-6 \le y \le 6$
B. $1 \le y \le 7$
C. $-4 \le y \le 4$
D. $-2 \le y \le 10$

7. (specs-06)

Which of the following lines is an asymptote for the graph of $y = \csc x$?

A. $x = 1$

B. $x = \frac{\pi}{2}$

C. $x = \frac{3\pi}{4}$

D. $x = \pi$

8. (specs-08)

Determine the domain of $f(x) = \tan 2x$.

A. all real numbers

B. all real numbers,
$x \neq (2n+1)\frac{\pi}{4}$, ($n$ is any integer)

C. all real numbers,
$x \neq (2n+1)\frac{\pi}{2}$, ($n$ is any integer)

D. all real numbers,
$x \neq (2n+1)\pi$, (n is any integer)

9. (sample02-02)

Convert 150° to radians.

A. $\frac{2\pi}{3}$

B. $\frac{3\pi}{2}$

C. $\frac{5\pi}{6}$

D. $\frac{6\pi}{5}$

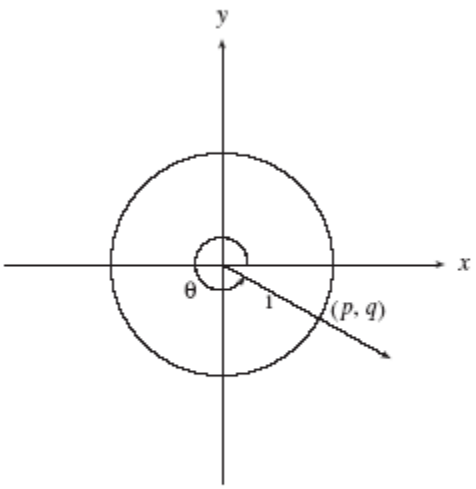
10. (sample02-06)

Solve: $\tan x + \sin x = 1, \quad 0 \le x < 2\pi$

A. 0.49, 4.22
B. 2.06, 5.80
C. 0.49, 1.57, 4.22, 4.71
D. 1.57, 2.06, 4.71, 5.80

11. (sample02-01)

If the diagram below shows a unit circle, determine $\cos\theta$.



A. p
B. q
C. $-p$
D. $-q$

12. (sample02-03)

Determine the period of the function $y = \tan\frac{\pi}{5}x$.

A. 5

B. 10

C. $\frac{\pi}{5}$

D. $\frac{\pi}{10}$

13. (sample02-07)

Which expression is equivalent to $\frac{\cos 8x + 1}{2}$?

A. $\cos^2 4x$
B. $\sin^2 4x$
C. $\cos^2 16x$
D. $\sin^2 16x$

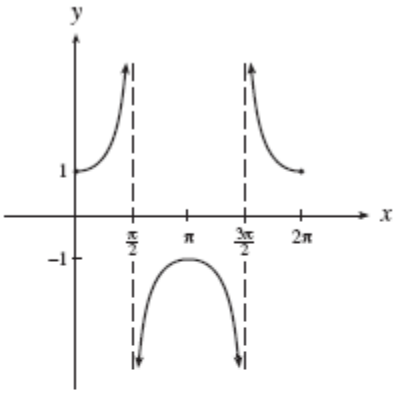
14. (jan02-01)

Convert 5.3 radians to degrees.

A. 0.09°
B. 0.18°
C. 151.83°
D. 303.67°

15. (sample02-04)
Which graph best represents $y = \sec x$, $0 \le x \le 2\pi$?

A.



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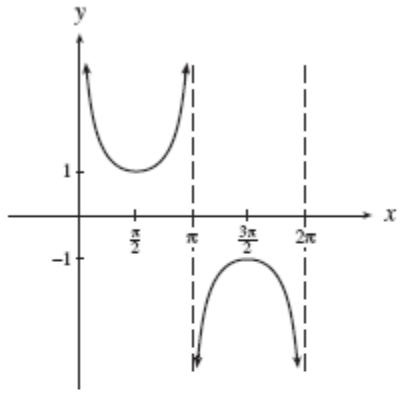

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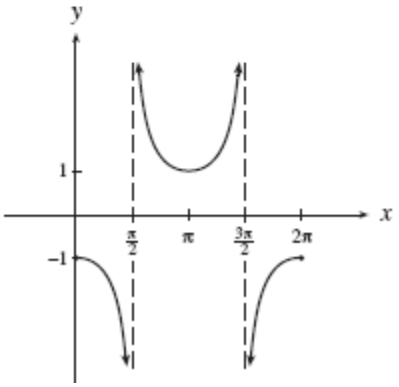
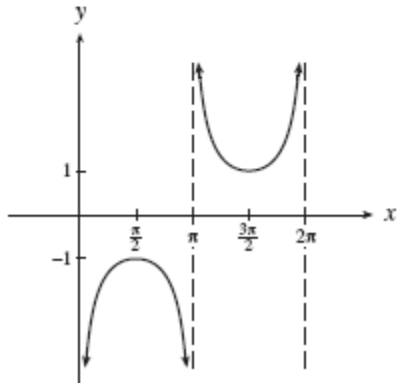


D.



16. (sample02-05)
Solve: $\sqrt{3} + 2\sin x = 0$, $0 \le x < 2\pi$ (Give exact solutions.)

A. $\frac{\pi}{3}, \frac{2\pi}{3}$

B. $\frac{4\pi}{3}, \frac{5\pi}{3}$

C. $\frac{\pi}{6}, \frac{5\pi}{6}$

D. $\frac{7\pi}{6}, \frac{11\pi}{6}$

17. (sample02-08)
In the function $y = a\sin(x - c) + d$ where a, c and d are positive constants, determine the range of the new function formed if a is doubled.

A. $d - \frac{a}{2} \le y \le d + \frac{a}{2}$

B. $d - 2a \le y \le d + 2a$

C. $-d - \frac{a}{2} \le y \le -d + \frac{a}{2}$

D. $-d - 2a \le y \le -d + 2a$

18. (sample02-09)
Determine the general solution: $3\sin 5x = 1$

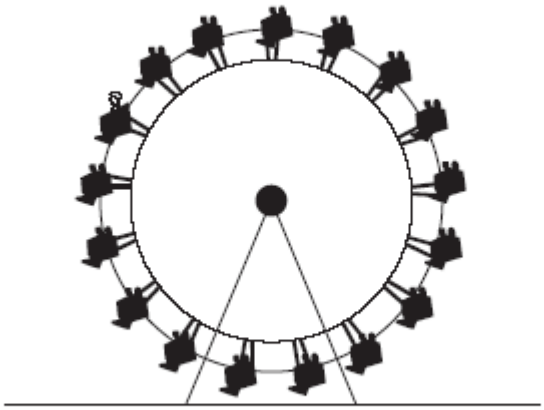
A. $x = 0.07 + \frac{2n\pi}{5},\ x = 0.56 + \frac{2n\pi}{5}$

B. $x = 0.07 + \frac{2n\pi}{5},\ x = 5.94 + \frac{2n\pi}{5}$

C. $x = 0.07 + 2n\pi,\ x = 0.56 + 2n\pi$

D. $x = 0.07 + 2n\pi,\ x = 5.94 + 2n\pi$

19. (sample02-10)
The Ferris wheel shown in the diagram has a radius of 16 m and its centre is 18 m above the ground. It rotates once every 60 s. Ethan gets on the Ferris wheel at its lowest point and then the wheel starts to rotate. How long does it take Ethan to reach 29 m above the ground for the first time?



A. 11.12 s
B. 22.24 s
C. 23.92 s
D. 37.76 s

20. (jan02-04)
The point $P(m,\ n)$ is the intersection point of the terminal arm of angle θ in standard position and the unit circle $x^2 + y^2 = 1$. Which expression represents $\sin\theta$?

A. m

B. n

C. $\frac{m}{n}$

D. $\frac{n}{m}$

21. (jan02-06)
Simplify: $\frac{\sin 2\theta}{\sin\theta}$

A. 2
B. $\sin\theta$
C. $\cos\theta$
D. $2\cos\theta$

22. (jan02-02)

Determine the period of $y = 6\cos\frac{2\pi}{15}x + 8$.

A. $\frac{2}{15}$

B. $\frac{15}{2}$

C. 15

D. 30

23. (jan02-03)

Determine the exact value of $\tan\frac{5\pi}{6}$.

A. $-\frac{\sqrt{3}}{2}$

B. $-\frac{1}{\sqrt{3}}$

C. $\frac{1}{\sqrt{3}}$

D. $\frac{\sqrt{3}}{2}$

24. (jan02-05)

Which of the following is an asymptote of $y = \sec x$?

A. $x = 0$

B. $x = \frac{\pi}{4}$

C. $x = \frac{\pi}{2}$

D. $x = \pi$

25. (jan02-07)

Which expression is equivalent to $\frac{\cos x + \cot x}{\sin x + 1}$?

A. $\sec x$
B. $\csc x$
C. $\cot x$
D. $\tan x$

26. (jan02-09)

Solve: $\sin 3x + \tan x = 3,\ 0 \le x < 2\pi$

A. 1.31, 4.34
B. 2.44, 3.85
C. 1.31, 1.57, 4.34, 4.71
D. 0, 2.44, 3.14, 3.85

27. (jan02-08)

Which expression is equivalent to $\sin\left(x+\frac{\pi}{3}\right)+\sin\left(x-\frac{\pi}{3}\right)$?

A. $\frac{\sqrt{3}}{4}\sin x$

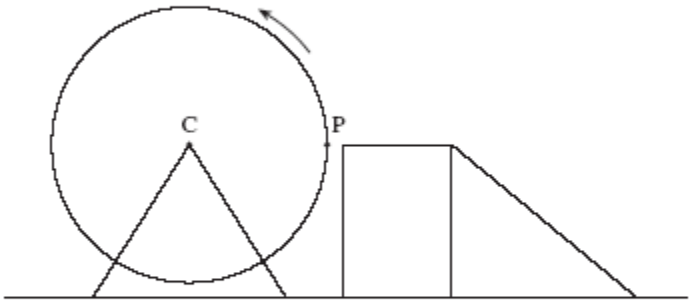
B. $\sin x$

C. $\sqrt{3}\sin x$

D. $2\sin x$

28. (jan02-10)

A Ferris wheel has a radius of 18 metres and a centre C which is 20 m above the ground. It rotates once every 32 seconds in the direction shown in the diagram. A platform allows a passenger to get on the Ferris wheel at a point P which is 20 m above the ground. If the ride begins at point P, when the time $t = 0$ seconds, determine a sine function that gives the passenger's height, h, in metres, above the ground as a function of t.



A. $h(t) = 18\sin\frac{\pi}{16}t + 20$

B. $h(t) = 18\sin\frac{\pi}{32}t + 20$

C. $h(t) = 20\sin\frac{\pi}{16}t + 18$

D. $h(t) = 20\sin\frac{\pi}{32}t + 18$

29. (apr02-01)

Determine the period of $y = \tan x$.

A. 1 radian

B. $\frac{\pi}{2}$ radians

C. π radians

D. 2π radians

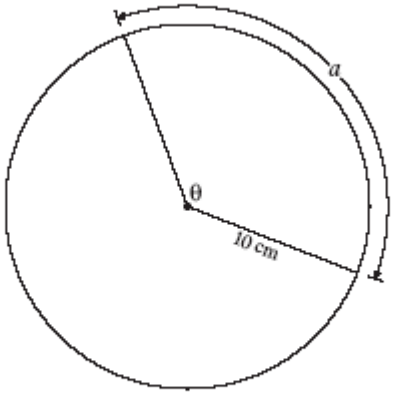
30. (apr02-04)

Solve: $\cos x = 2x$, $0 \le x < 2\pi$

A. 0.45
B. 0.58
C. 0.90
D. no solution

31. (apr02-02)

Given a circle with radius 10 cm, calculate the length of arc a which contains a sector angle $\theta = 2$ radians.



A. 5π cm
B. 10π cm
C. 10 cm
D. 20 cm

32. (apr02-03)

Find the exact value of $\tan\frac{5\pi}{3}$.

A. $-\sqrt{3}$
B. $-\frac{1}{\sqrt{3}}$
C. $\frac{1}{\sqrt{3}}$
D. $\sqrt{3}$

33. (apr02-05)

The expression $\cos 3x \cos 2x - \sin 3x \sin 2x$ is equal to

A. $\sin x$
B. $\sin 5x$
C. $\cos x$
D. $\cos 5x$

34. (apr02-06)

Solve: $2\cos^2 x - 1 = 0$, $0 \le x < 2\pi$

A. $\frac{\pi}{4}, \frac{7\pi}{4}$
B. $\frac{\pi}{3}, \frac{5\pi}{3}$
C. $\frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$
D. $\frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$

35. (apr02-07)
Determine the maximum value of the function $f(x) = a\cos x + d$, where $a > 0$ and $d > 0$.

A. a
B. $d - a$
C. $a + d$
D. $2a + d$

36. (apr02-08)
Simplify: $\frac{\cos\theta}{\cot\theta} + \frac{1}{\csc\theta}$

A. $\csc\theta$
B. $2\sin\theta$
C. $2\cot\theta$
D. $\sin\theta + \cos\theta$

37. (apr02-09)
The terminal arm of angle θ in standard position passes through point (m, n) where $m > 0, n > 0$. Determine the value of $\sin(\pi + \theta)$.

A. $\frac{-n}{\sqrt{m^2 + n^2}}$

B. $\frac{-m}{\sqrt{m^2 + n^2}}$

C. $\frac{n}{\sqrt{m^2 + n^2}}$

D. $\frac{m}{\sqrt{m^2 + n^2}}$

38. (apr02-10)
A wheel of radius 30 cm has its centre 36 cm above the ground. It rotates once every 12 seconds. Determine an equation for the height, h, above the ground of a point on the wheel at time t seconds if this point has a minimum height at $t = 0$ seconds.

A. $h = -30\cos\frac{\pi}{12}t + 6$

B. $h = -30\cos\frac{\pi}{6}t + 6$

C. $h = -30\cos\frac{\pi}{12}t + 36$

D. $h = -30\cos\frac{\pi}{6}t + 36$

39. (jun02-01)
Convert 210^0 to radians.

A. 1.83
B. 2.69
C. 3.49
D. 3.67

40. (jun02-02)
Determine an expression equivalent to $\sec\theta\cot\theta\sin\theta$.

A. 1
B. $\cot\theta$
C. $\csc\theta$
D. $\tan\theta$

41. (jun02-03)
Determine the exact value of $\sec\frac{7\pi}{4}$.

A. $-\sqrt{2}$
B. $-\frac{1}{\sqrt{2}}$
C. $\frac{1}{\sqrt{2}}$
D. $\sqrt{2}$

42. (jun02-04)
Determine the period of the function $y = 3\cos 4x$.

A. $\frac{\pi}{2}$
B. $\frac{2\pi}{3}$
C. 6π
D. 8π

43. (jun02-05)
Determine the range of the function $y = -2\sin 3x + 4$.

A. $-6 \le y \le -2$
B. $-2 \le y \le 2$
C. $0 \le y \le 4$
D. $2 \le y \le 6$

44. (jun02-06)
Solve: $2\cos x + \sqrt{3} = 0, \quad 0 \le x < 2\pi$

A. $\frac{5\pi}{6}, \frac{7\pi}{6}$
B. $\frac{4\pi}{3}, \frac{5\pi}{3}$
C. $\frac{2\pi}{3}, \frac{4\pi}{3}$
D. $\frac{7\pi}{6}, \frac{11\pi}{6}$

45. (jun02-07)
Solve: $\sin 2x + \cos 3x = 1.5, \quad 0 \le x < 2\pi$

A. 3.84, 4.37
B. 4.97, 5.12
C. 5.07, 5.58
D. 1.20, 1.90, 3.76, 5.64

46. (jun02-08)
Simplify: $\sin(2x + \pi)$

A. $\sin 2x$
B. $\cos 2x$
C. $-\sin 2x$
D. $-\cos 2x$

47. (jun02-09)
The two smallest positive solutions of $\sin 3x = 0.4$ are $x = 0.14$ and $x = 0.91$. Determine the general solution of $\sin 3x = 0.4$.

A. $x = 0.14 + 2n\pi, \quad x = 0.91 + 2n\pi, \quad (n \text{ is an integer})$

B. $x = 0.14 + 6n\pi, \quad x = 0.91 + 6n\pi, \quad (n \text{ is an integer})$

C. $x = 0.14 + \frac{n\pi}{3}, \quad x = 0.91 + \frac{n\pi}{3}, \quad (n \text{ is an integer})$

D. $x = 0.14 + \frac{2n\pi}{3}, \quad x = 0.91 + \frac{2n\pi}{3}, \quad (n \text{ is an integer})$

48. (jun02-10)
The function $h(t) = 3.9 \sin 0.16\pi(t - 3) + 6.5$ gives the depth of water, h metres, at any time, t hours, during a certain day. A cruise ship needs at least 8 metres of water to dock safely. Use the graph of the function to estimate the number of hours in the 24 hour interval starting at $t = 0$ during which the cruise ship can dock safely.

A. 3.79
B. 4.68
C. 7.57
D. 9.36

49. (aug02-01)
Determine the amplitude of $y = -5 \sin \pi(x - 3) + 4$.

A. -5
B. 3
C. 4
D. 5

50. (aug02-02)
Convert 135° to radians.

A. 1.18
B. 1.92
C. 2.36
D. 4.71

51. (aug02-03)
Determine the period of $y = \tan 4x$.

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. 2π

D. 4π

52. (aug02-04)
Determine the exact value of $\sec\frac{11\pi}{6}$.

A. -2

B. 2

C. $-\frac{2}{\sqrt{3}}$

D. $\frac{2}{\sqrt{3}}$

53. (aug02-05)
Simplify: $\frac{\csc^2 x - 1}{\csc^2 x}$

A. $\cos^2 x$
B. $\sin^2 x$
C. $-\cos^2 x$
D. $-\sin^2 x$

54. (aug02-06)
Solve: $\sqrt{2}\sin x + 1 = 0, \quad 0 \le x < 2\pi$

A. $\frac{\pi}{4}, \frac{3\pi}{4}$

B. $\frac{\pi}{4}, \frac{7\pi}{4}$

C. $\frac{3\pi}{4}, \frac{5\pi}{4}$

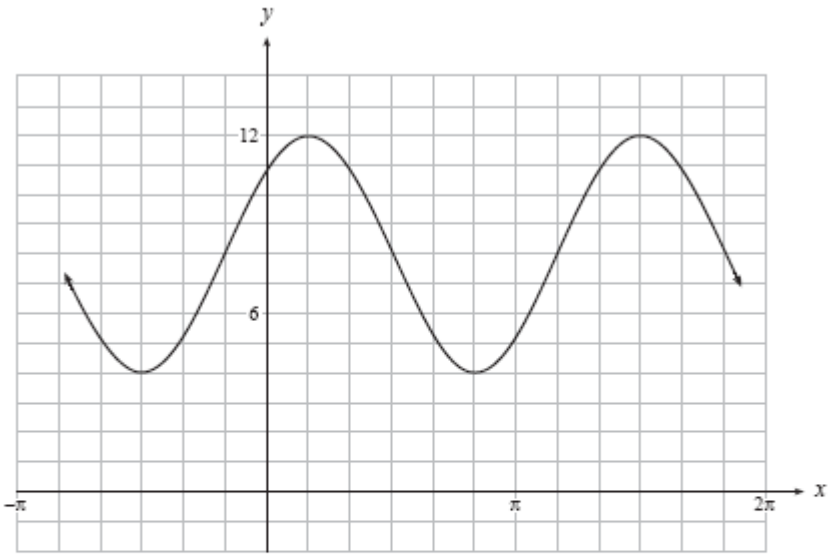
D. $\frac{5\pi}{4}, \frac{7\pi}{4}$

55. (aug02-07)
Solve: $3\cos 2x = -x, \quad 0 \le x < 2\pi$

A. 0.67
B. 0.52, 1.57
C. 0.67, 3.07
D. 0.95, 1.99

56. (aug02-08)

Which equation represents the sine function graphed below?



A. $y = 4\sin\frac{4}{3}\left(x+\frac{\pi}{6}\right)+8$

B. $y = 4\sin\frac{4}{3}\left(x-\frac{\pi}{6}\right)+8$

C. $y = 4\sin\frac{3}{2}\left(x-\frac{\pi}{6}\right)+8$

D. $y = 4\sin\frac{3}{2}\left(x+\frac{\pi}{6}\right)+8$

57. (aug02-09)

A wheel rolling along the ground has a radius of 32 cm and rotates once every 8 seconds. At time $t = 0$ seconds, a point P on the outside edge of the wheel is touching the ground. Determine a cosine function that gives the height, h, of point P above the ground at any time, t, where h is in cm and t is in seconds.

A. $h(t) = -32\cos\frac{\pi}{4}t$

B. $h(t) = -32\cos 2\pi t$

C. $h(t) = -32\cos\frac{\pi}{4}t + 32$

D. $h(t) = -32\cos 2\pi t + 32$

58. (aug02-10)

Determine the number of solutions for $(a\sin x + a)(b\cos x - c) = 0$ for $0 \le x < 2\pi$, if $1 < a < b < c$.

A. 1
B. 2
C. 3
D. 4

59. (jan03-01)

Convert $\frac{5\pi}{2}$ radians to degrees.

A. $90°$
B. $180°$
C. $270°$
D. $450°$

60. (jan03-02)

Determine the range of the function $y = 4\cos x - 2$.

A. $-4 \le y \le 4$
B. $-2 \le y \le 6$
C. $-6 \le y \le 2$
D. $2 \le y \le 6$

61. (jan03-03)

Solve: $\sin 2x - \cos x = 1, \quad 0 \le x < 2\pi$

A. 0, 5.07
B. 3.14, 4.32
C. 3.14, 4.36
D. 0.42, 1.89, 2.95, 4.21

62. (jan03-04)

Determine the exact value of $\cot\frac{5\pi}{3}$.

A. $\sqrt{3}$
B. $-\sqrt{3}$
C. $\frac{1}{\sqrt{3}}$
D. $-\frac{1}{\sqrt{3}}$

63. (jan03-05)

Determine the period of the function $f(x) = -\frac{1}{2}\sin\frac{x}{3}$.

A. $\frac{2\pi}{3}$
B. π
C. 4π
D. 6π

64. (jan03-07)

Determine an expression equivalent to $\frac{\tan\theta\csc^2\theta}{\sec^2\theta}$.

A. $\tan\theta$
B. $\cot\theta$
C. $\tan^2\theta$
D. $\tan^3\theta$

65. (jan03-06)
Solve: $2\sin x + 1 = 0, \quad 0 \le x < 2\pi$

A. $-\frac{\pi}{6}, -\frac{5\pi}{6}$

B. $\frac{\pi}{6}, \frac{5\pi}{6}$

C. $\frac{7\pi}{6}, \frac{11\pi}{6}$

D. $\frac{4\pi}{3}, \frac{5\pi}{3}$

66. (jan03-08)
Simplify: $\cos(\pi - 2x)$

A. $-\cos 2x$
B. $-\sin 2x$
C. $\cos 2x$
D. $\sin 2x$

67. (jan03-09)
A wheel with radius 20 cm has its centre 30 cm above the ground. It rotates once every 15 seconds. Determine an equation for the height, h, above the ground of a point on the wheel at time t seconds if this point has a maximum height at $t = 2$ seconds.

A. $h = 20\cos\frac{2\pi}{15}(t+2) + 30$

B. $h = 20\cos\frac{2\pi}{15}(t-2) + 30$

C. $h = 30\cos\frac{2\pi}{15}(t+2) + 20$

D. $h = 30\cos\frac{2\pi}{15}(t-2) + 20$

68. (jan03-10)
Determine a cosine equation that has the following general solution: $\frac{\pi}{2} + n\pi$, $\frac{\pi}{6} + 2n\pi$, $\frac{11\pi}{6} + 2n\pi$, where n is an integer.

A. $\cos x\left(2\cos x + \sqrt{2}\right) = 0$

B. $\cos x\left(2\cos x + \sqrt{3}\right) = 0$

C. $\cos x\left(2\cos x - \sqrt{2}\right) = 0$

D. $\cos x\left(2\cos x - \sqrt{3}\right) = 0$

69. (apr03-02)
Simplify: $\frac{2\sin\theta}{\sin 2\theta}$

A. 1
B. $\cos\theta$
C. $\csc\theta$
D. $\sec\theta$

70. (apr03-01)

Give the exact value of $\cos\frac{11\pi}{6}$.

A. $-\frac{\sqrt{3}}{2}$

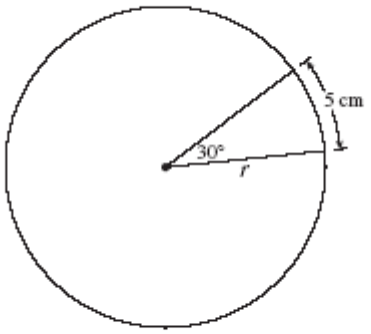
B. $-\frac{\sqrt{2}}{2}$

C. $\frac{\sqrt{2}}{2}$

D. $\frac{\sqrt{3}}{2}$

71. (apr03-03)

An arc of length 5 cm subtends an angle of $30°$ at the centre of a circle with radius r, as shown in the diagram. Determine the value of r.



A. 4.77
B. 6.00
C. 9.55
D. 10.00

72. (apr03-04)

Determine the period of $y = \tan \pi x$.

A. 1

B. 2

C. $\frac{\pi}{2}$

D. π

73. (apr03-06)

Simplify: $\sin\left(\frac{3\pi}{2} + x\right)$

A. $\sin x$
B. $\cos x$
C. $-\sin x$
D. $-\cos x$

74. (apr03-05)

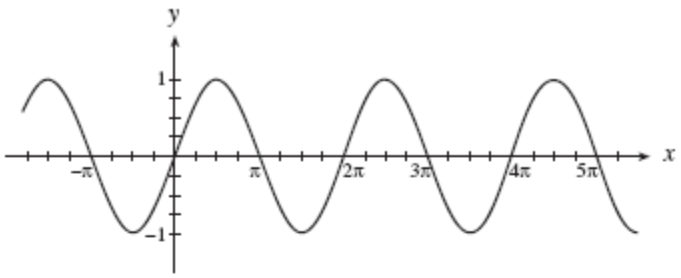
Solve: $3\sin x = x + 1, \quad 0 \le x < 2\pi$

A. 0.25
B. 1.87, 2.87
C. 0.54, 1.54
D. 0.54, 1.87

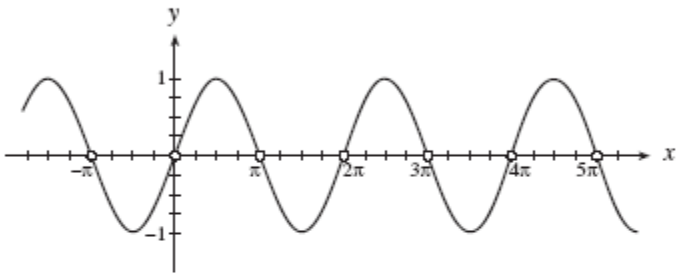
75. (jan03-23)

Which graph best represents the function $\log y = \log(\sin x)$?

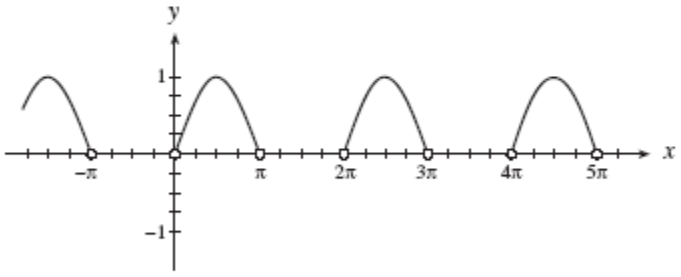
A.



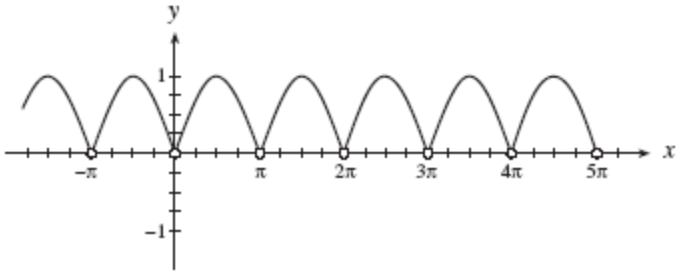
B.



C.



D.



76. (apr03-07)
Solve: $\sin^2 x = \sin x \cos x, \quad 0 \le x < 2\pi$

A. $x = 0, \ \frac{\pi}{4}$

B. $x = \frac{\pi}{4}, \ \frac{5\pi}{4}$

C. $x = 0, \ \frac{3\pi}{4}, \ \pi, \ \frac{7\pi}{4}$

D. $x = 0, \ \frac{\pi}{4}, \ \pi, \ \frac{5\pi}{4}$

77. (apr03-08)
The terminal arm of angle θ in standard position passes through the point $(-2, 5)$. Determine the value of $\sec\theta$.

A. $-\frac{\sqrt{21}}{2}$

B. $\frac{\sqrt{21}}{5}$

C. $-\frac{\sqrt{29}}{2}$

D. $\frac{\sqrt{29}}{5}$

78. (apr03-09)
Determine the range of the function $y = b\cos ax - 2b$, where $a > 0, \ b > 0$.

A. $b \le y \le 3b$
B. $-3b \le y \le -b$
C. $b - a \le y \le b + a$
D. $2b - a \le y \le 2b + a$

79. (apr03-23)
If x is an angle in standard position, in which quadrants is the expression $\log(\cos x)$ defined?

A. Quadrant 1, Quadrant 2
B. Quadrant 1, Quadrant 4
C. Quadrant 2, Quadrant 3
D. Quadrant 3, Quadrant 4

80. (jun03-01)
Convert 120° to radians.

A. $\frac{2\pi}{3}$

B. $\frac{5\pi}{6}$

C. $\frac{3\pi}{2}$

D. $\frac{6\pi}{5}$

81. (apr03-10)

Determine the general solution for: $\sin 2x = -\frac{1}{2}$

A. $\frac{7\pi}{12} + 2n\pi,\ \frac{11\pi}{12} + 2n\pi$ (n is any integer)

B. $\frac{7\pi}{12} + n\pi,\ \frac{11\pi}{12} + n\pi$ (n is any integer)

C. $\frac{13\pi}{12} + 2n\pi,\ \frac{21\pi}{12} + 2n\pi$ (n is any integer)

D. $\frac{13\pi}{12} + n\pi,\ \frac{21\pi}{12} + n\pi$ (n is any integer)

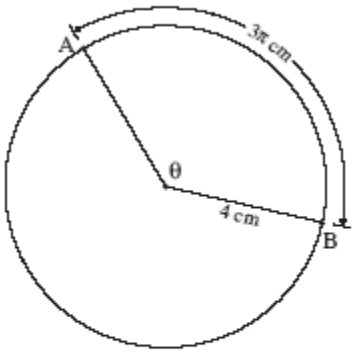
82. (jun03-02)

Determine the amplitude of $y = -2\sin 4\left(x - \frac{\pi}{3}\right) + 3$.

A. –2
B. 2
C. 3
D. 4

83. (jun03-03)

A circle has a radius of 4 cm. If the length of arc AB shown on the diagram is 3π cm, determine the measure of the central angle θ in radians.



A. $\frac{3\pi}{4}$

B. $\frac{4}{3\pi}$

C. $\frac{3\pi}{2}$

D. 3π

84. (jun03-04)

Solve: $\tan x - \cos x = -2, \quad 0 \le x < 2\pi$

A. 1.17, 4.10
B. 1.97, 5.32
C. 1.17, 1.57, 4.10, 4.71
D. 1.57, 1.97, 4.71, 5.32

85. (jun03-05)

Solve: $4\cos^2 x = 3, \quad 0 \le x < 2\pi$

A. $\frac{\pi}{6}, \frac{11\pi}{6}$

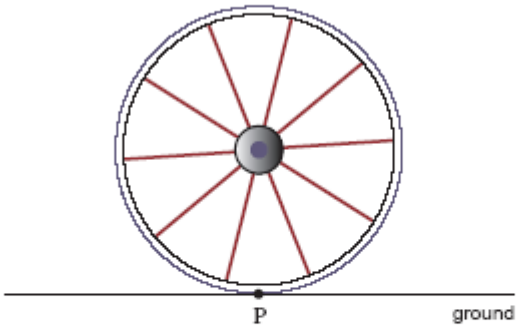
B. $\frac{\pi}{3}, \frac{5\pi}{3}$

C. $\frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$

D. $\frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$

86. (jun03-06)

A wheel with diameter 10 cm is rolling along the ground. Point P on the edge of the wheel is on the ground as shown in the diagram at time $t = 0$ seconds. Which equation gives the height, h, of point P above the ground at time t seconds, if the wheel rotates once every 12 seconds?



A. $h = -5\cos\frac{\pi}{12}t$

B. $h = -5\cos\frac{\pi}{6}t$

C. $h = -5\cos\frac{\pi}{12}t + 5$

D. $h = -5\cos\frac{\pi}{6}t + 5$

87. (jun03-07)

Determine an expression equivalent to $\tan\theta + \cot\theta$.

A. 1
B. $\sin\theta\cos\theta$
C. $\sec\theta\csc\theta$
D. $\sin\theta + \cos\theta$

88. (jun03-09)

Which expression is equivalent to $6\sin 8x\cos 8x$?

A. $\sin 8x$
B. $\sin 16x$
C. $3\sin 4x$
D. $3\sin 16x$

89. (jun03-08)
The point $(p,\ q)$ is the point of intersection of the terminal arm of angle θ in standard position and the unit circle centred at $(0,\ 0)$. Which expression represents $\sec\theta$?

A. q

B. p

C. $\frac{1}{q}$

D. $\frac{1}{p}$

90. (jun03-10)
Determine the equations of the asymptotes of the function $y = \tan bx$, where $b > 0$.

A. $x = \frac{n\pi}{b}$, n is an integer

B. $x = \frac{n\pi}{2b}$, n is an integer

C. $x = \frac{\pi}{b} + \frac{n\pi}{b}$, n is an integer

D. $x = \frac{\pi}{2b} + \frac{n\pi}{b}$, n is an integer

91. (aug03-01)
Convert $100°$ to radians.

A. 0.18
B. 0.57
C. 1.75
D. 5.66

92. (aug03-02)
Give the period of $y = 2\sec x$.

A. $\frac{1}{2\pi}$

B. $\frac{\pi}{2}$

C. π

D. 2π

93. (aug03-04)
Give the range of $y = 5\sin\frac{1}{2}x + 8$.

A. $3 \le y \le 8$
B. $3 \le y \le 13$
C. $-13 \le y \le -3$
D. $-13 \le y \le 13$

94. (aug03-03)

Determine the exact value of $\tan\frac{2\pi}{3}$.

A. $-\sqrt{3}$

B. $-\frac{1}{\sqrt{3}}$

C. $\frac{1}{\sqrt{3}}$

D. $\sqrt{3}$

95. (aug03-05)

Simplify: $4-8\sin^2 6x$

A. $\cos 12x$
B. $2\cos 6x$
C. $4\cos 6x$
D. $4\cos 12x$

96. (aug03-06)

Determine an equation of an asymptote of $y = 2\tan x$.

A. $x = \frac{\pi}{4}$

B. $x = \frac{\pi}{2}$

C. $x = \pi$

D. $x = 2\pi$

97. (aug03-07)

Solve: $\sin x = \frac{1}{x}, \quad 0 \le x < 2\pi$

A. 0, 1.56
B. 1.11, 2.77
C. 3.44, 6.11
D. 0, 3.14, 6.28

98. (aug03-08)

At a seaport, the water has a maximum depth of 18 m at 3:00 am. After this maximum depth, the first minimum depth of 4 m occurs at 9:30 am. Assume that the relation between the depth, h metres, and the time, t hours, is a sinusoidal function. Determine an equation for h at any time t.

A. $h = 7\cos 2\pi\frac{(t-3)}{6.5}+11$

B. $h = 7\cos 2\pi\frac{(t-3)}{13}+11$

C. $h = 11\cos 2\pi\frac{(t-3)}{6.5}+7$

D. $h = 11\cos 2\pi\frac{(t-3)}{13}+7$

99. (aug03-09)

Point P is the intersection of the terminal arm of angle θ in standard position and the unit circle with centre $(0,\ 0)$. If P is in quadrant 3 and $\cos\theta = m$, determine the coordinates of P in terms of m.

A. $\left(-m,\ \sqrt{1-m^2}\right)$

B. $\left(-m,\ -\sqrt{1-m^2}\right)$

C. $\left(m,\ \sqrt{1-m^2}\right)$

D. $\left(m,\ -\sqrt{1-m^2}\right)$

100. (aug03-10)

Determine the number of solutions in the interval $0 \le x < 2\pi$ for:

$$\sin ax = 0.5, \quad a \text{ is an integer, where } a \ge 1$$

A. 2

B. $\frac{a}{2}$

C. a

D. $2a$

101. (jan04-01)

Convert $\frac{8\pi}{3}$ radians to degrees.

A. $60°$
B. $120°$
C. $240°$
D. $480°$

102. (jan04-02)

Determine the minimum value of the function $y = -3\sin 2x + 4$.

A. -7
B. -3
C. -1
D. 1

103. (jan04-04)

Determine the exact value of $\sec\frac{5\pi}{4}$.

A. $-\sqrt{2}$

B. $-\frac{1}{\sqrt{2}}$

C. $\frac{1}{\sqrt{2}}$

D. $\sqrt{2}$

104. (jan04-03)
Solve: $2\sin x = \cos 3x$, where $0 \le x < 2\pi$

A. 0.31, 3.45
B. 2.83, 5.98
C. 0.39, 2.75, 4.03, 5.30
D. 0.98, 2.16, 3.55, 5.89

105. (jan04-05)
The terminal arm of angle θ, in standard position, passes through the point $(-2,\ 9)$.
Determine the value of $\sin\theta$.

A. $\frac{-2}{\sqrt{77}}$

B. $\frac{9}{\sqrt{77}}$

C. $\frac{-2}{\sqrt{85}}$

D. $\frac{9}{\sqrt{85}}$

106. (jan04-07)
Simplify: $4\cos^2 6x - 2$

A. $2\cos 3x$
B. $4\cos 3x$
C. $2\cos 12x$
D. $4\cos 12x$

107. (jan04-08)
In a seaport, the function $d(t) = 2.6\sin 0.25(t-5) + 3.3$ can be used to approximate the depth of the water, d metres, at time t hours after midnight. Estimate the number of hours in the 24-hour interval starting at $t = 0$ when the depth of the water is at least 3.5 m.

A. 5.31 h
B. 11.95 h
C. 17.26 h
D. 23.90 h

108. (jan04-09)
The smallest positive solution of $\tan bx = 2$ is $x = 0.3$. Determine the general solution of $\tan bx = 2$.

A. $0.3 + 2n\pi$, n is an integer

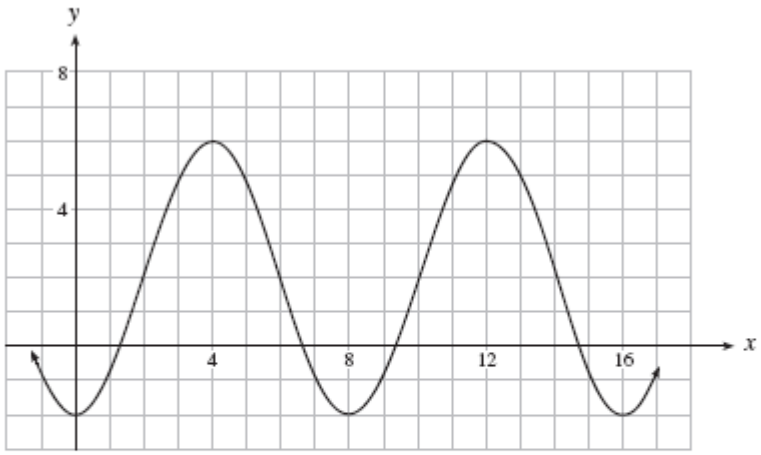
B. $0.3 + 2bn\pi$, n is an integer

C. $0.3 + \frac{n\pi}{b}$, n is an integer

D. $0.3 + \frac{2n\pi}{b}$, n is an integer

109. (jan04-06)

If the graph of the function shown below has the equation $y = a\sin b(x-c)+d$, determine the value of b. $(b>0)$



A. 4

B. 8

C. $\frac{\pi}{4}$

D. $\frac{\pi}{8}$

110. (apr04-01)

Convert 200 degrees to radians.

A. $\frac{10\pi}{9}$

B. $\frac{9\pi}{10}$

C. $\frac{9\pi}{5}$

D. $\frac{5\pi}{9}$

111. (apr04-03)

Evaluate: $\csc\frac{5\pi}{3}$

A. -2

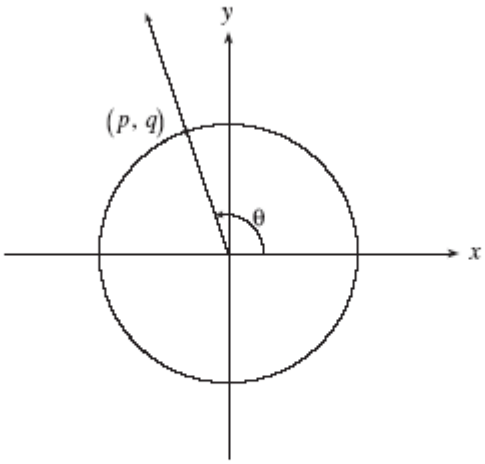
B. $\frac{-2}{\sqrt{3}}$

C. $\frac{2}{\sqrt{3}}$

D. 2

112. (apr04-02)

The point (p, q) is the point of intersection of the terminal arm of angle θ in standard position and the unit circle centred at $(0, 0)$ as shown in the diagram. Which expression represents $\tan\theta$?



A. p

B. q

C. $\frac{p}{q}$

D. $\frac{q}{p}$

113. (apr04-04)

State the phase shift of the function:

$$y = -\cos\left(4x - \frac{\pi}{2}\right)$$

A. $\frac{\pi}{8}$ to the right

B. $\frac{\pi}{8}$ to the left

C. $\frac{\pi}{2}$ to the right

D. $\frac{\pi}{2}$ to the left

114. (apr04-05)

A pendulum 15 cm long swings through an arc of length 30 cm. Through what angle does the pendulum swing? (Answer accurate to the nearest degree.)

A. $2°$
B. $60°$
C. $75°$
D. $115°$

115. (apr04-08)

Simplify: $\sin(\pi + x) - \sin(\pi - x)$

A. $-2\cos x$
B. $-2\sin x$
C. $2\cos x$
D. $2\sin x$

116. (apr04-06)
Solve: $2\cos^2 x - \cos x - 1 = 0, \quad 0 \le x < 2\pi$

A. $x = 0, \frac{5\pi}{6}, \frac{7\pi}{6}$

B. $x = 0, \frac{2\pi}{3}, \frac{4\pi}{3}$

C. $x = \frac{\pi}{6}, \pi, \frac{11\pi}{6}$

D. $x = \frac{\pi}{3}, \pi, \frac{5\pi}{3}$

117. (apr04-07)
Determine all restrictions for the expression: $\frac{\sin x}{\cos x(2\cos x - 1)}$

A. $\cos x \neq 0, \ \cos x \neq \frac{1}{2}$

B. $\cos x \neq 0, \ \cos x \neq -\frac{1}{2}$

C. $\sin x \neq 0, \ \cos x \neq 0, \ \cos x \neq \frac{1}{2}$

D. $\sin x \neq 0, \ \cos x \neq 0, \ \cos x \neq -\frac{1}{2}$

118. (apr04-09)
Evaluate: $\sum_{k=1}^{4} \cos\frac{k\pi}{4}$

A. -1

B. 0

C. 1

D. $\frac{4}{\sqrt{2}}$

119. (jun04-02)
In a circle with radius 12 cm an arc of length 20 cm subtends a central angle of θ.
Determine the measure of θ in radians.

A. 0.60
B. 1.20
C. 1.67
D. 3.33

120. (jun04-03)
Solve: $7\tan x = -3, \quad 0 \le x < 2\pi$

A. 2.74, 3.55
B. 2.74, 5.88
C. 0.40, 3.55
D. 0.40, 5.88

121. (jun04-01)

Determine the exact value of $\cos\frac{7\pi}{4}$.

A. $\frac{1}{\sqrt{2}}$

B. $\frac{\sqrt{3}}{2}$

C. $-\frac{\sqrt{3}}{2}$

D. $-\frac{1}{\sqrt{2}}$

122. (jun04-04)

Give the period of $f(x) = 3\csc x$.

A. $\frac{\pi}{3}$

B. π

C. 2π

D. 3π

123. (jun04-05)

Determine an expression equivalent to $\tan^2\theta\csc\theta + \frac{1}{\sin\theta}$.

A. $\sec^3\theta$

B. $\csc^3\theta$

C. $\csc^2\theta\sec\theta$

D. $\sec^2\theta\csc\theta$

124. (jun04-06)

Solve over the set of real numbers: $2\sin^2 x - 5\sin x - 3 = 0$

A. $\frac{\pi}{6} + n\pi$, $\frac{5\pi}{6} + n\pi$, n is an integer

B. $\frac{7\pi}{6} + n\pi$, $\frac{11\pi}{6} + n\pi$, n is an integer

C. $\frac{\pi}{6} + 2n\pi$, $\frac{5\pi}{6} + 2n\pi$, n is an integer

D. $\frac{7\pi}{6} + 2n\pi$, $\frac{11\pi}{6} + 2n\pi$, n is an integer

125. (jun04-08)

Determine an expression equivalent to $\cos(\pi + 2A)$.

A. $-\cos 2A$

B. $\cos 2A$

C. $-\sin 2A$

D. $\sin 2A$

126. (jun04-07)

Let θ be an angle in standard position such that $\tan\theta = \frac{2}{3}$ and $\sin\theta < 0$. Determine the exact value of $\sec\theta$.

A. $-\frac{\sqrt{13}}{2}$

B. $-\frac{\sqrt{13}}{3}$

C. $\frac{\sqrt{13}}{3}$

D. $\frac{\sqrt{13}}{2}$

127. (jun04-09)

For the function $f(x) = 3\sin bx + d$ where b and d are positive constants, determine an expression for the smallest positive value of x that produces the maximum value of $f(x)$.

A. $\frac{2\pi}{b}$

B. $\frac{\pi}{2b}$

C. $\frac{4\pi}{b}$

D. $\frac{\pi}{4b}$

128. (aug04-01)

An arc of length x cm subtends an angle of $\frac{2\pi}{5}$ radians at the centre of a circle with radius 10 cm. Determine the value of x.

A. 7.20

B. $\frac{25}{\pi}$

C. 10

D. 4π

129. (aug04-03)

Determine the amplitude of the function $y = -4\sin 3x - 2$.

A. -4

B. -2

C. 2

D. 4

130. (aug04-04)

Solve: $\log x = 2\cos x, \quad 0 < x < 2\pi$

A. 0.17, 0.71

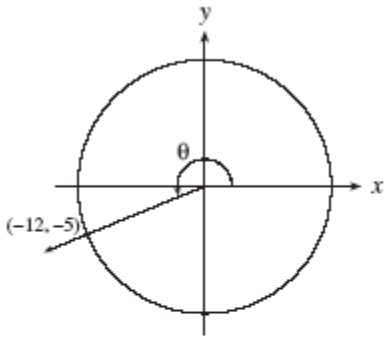
B. 1.38

C. 1.48, 5.07

D. 1.57, 5.11

131. (aug04-02)

Determine $\sec\theta$ using the information in the diagram below.



A. $-\frac{13}{12}$

B. $-\frac{13}{5}$

C. $\frac{13}{5}$

D. $\frac{13}{12}$

132. (aug04-05)

Determine the exact value of $\cot\left(-\frac{5\pi}{6}\right)$.

A. $-\sqrt{3}$

B. $-\frac{1}{\sqrt{3}}$

C. $\frac{1}{\sqrt{3}}$

D. $\sqrt{3}$

133. (aug04-06)

Determine the phase shift of the function: $f(x)=\cos\left(\frac{1}{3}x-\pi\right)$

A. $\frac{\pi}{3}$ to the right

B. π to the right

C. 3π to the right

D. 6π to the right

134. (aug04-08)

If $A=B+90°$, simplify $\cos A\cos B+\sin A\sin B$.

A. 0

B. 1

C. $\cos 2B$

D. $\cos(2B+90°)$

135. (aug04-07)
Solve: $\csc x + 2 = 0, \quad 0 \le x < 2\pi$

A. $\frac{\pi}{6}, \frac{5\pi}{6}$

B. $\frac{7\pi}{6}, \frac{11\pi}{6}$

C. $\frac{\pi}{3}, \frac{5\pi}{3}$

D. $\frac{2\pi}{3}, \frac{4\pi}{3}$

136. (aug04-09)
Determine the general solution for $\sin 2x = 1$.

A. $x = \frac{\pi}{2} + n\pi$, n is an integer

B. $x = \frac{\pi}{4} + n\pi$, n is an integer

C. $x = \frac{\pi}{6} + 2n\pi, \frac{5}{6}\pi + 2n\pi$, n is an integer

D. $x = \frac{\pi}{3} + 2n\pi, \frac{2}{3}\pi + 2n\pi$, n is an integer

Written Section

1. (specs-10)
A Ferris wheel has a diameter of 60 m and its centre is 32 m above the ground. It rotates once every 48 seconds. Jack gets on the Ferris wheel at its lowest point and then the wheel starts to rotate.

a) Determine a sinusoidal equation that gives Jack's height, h, above the ground as a function of the elapsed time, t, where h is in metres and t is in seconds.

b) Determine the time, t, when Jack will be 38 m above the ground in the first rotation of the Ferris wheel.

2. (specs-11)
Solve $\cos^2 x = \cos x$ over the set of real numbers. Give exact value solutions.

3. (specs-12)
Prove the following identity: $\dfrac{\sin 2x}{1-\cos 2x} = \cot x$

4. (sample02-04)
Prove the identity: **(5 marks)**

$$\frac{\cot\theta}{\sin\theta - \csc\theta} = -\sec\theta$$

5. (jan02-04)
Solve $2\cos^2 x + \cos x - 1 = 0$ algebraically over the set of real numbers. (Give the general solution using exact values.) **(5 marks)**

6. (jun02-05)
Prove the identity: **(5 marks)**

$$\sin 2x(\tan x + \cot x) = 2$$

7. (aug02-02)
Prove: **(5 marks)**

$$\frac{2\cos x + 2\cos^2 x}{\sin 2x} = \frac{\sin x}{1-\cos x}$$

8. (jan03-07)
Solve the following equation algebraically. **(4 marks)**

$$3\cos^2 x + \cos x - 2 = 0, \quad 0 \le x < 2\pi$$

9. (jan03-08)
Prove the identity: **(5 marks)**

$$(\csc\theta - \sin\theta)\tan\theta = \frac{\sin 2\theta}{2\sin\theta}$$

10. (apr03-07)
A Ferris wheel has a radius of 25 m and its centre is 27 m above the ground. It rotates once every 40 seconds. Sandy gets on the Ferris wheel at its lowest point and then the wheel starts to rotate.

a) Determine a sinusoidal equation that gives Sandy's height, h, above the ground as a function of the elapsed time, t, where h is in metres and t is in seconds. **(3 marks)**

b) Determine the first time, t (in seconds), when Sandy will be 35 m above the ground. **(1 mark)**

11. (apr03-08)

Prove the identity: **(5 marks)**

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

12. (jun03-07)

a) Solve algebraically, giving exact values for x, where $0 \le x < 2\pi$. **(3 marks)**

$$2\sin^2 x - \sin x = 0$$

b) Give the general solution for this equation.
(Solve over the set of real numbers, giving exact value solutions.) **(1 mark)**

13. (jun03-08)

Prove: **(5 marks)**

$$\frac{\cot\theta}{\sin\theta - \csc\theta} = -\sec\theta$$

14. (aug03-07)

a) Solve algebraically, giving exact values for x, where $0 \le x < 2\pi$. **(3 marks)**

$$2\cos^2 x - \cos x - 1 = 0$$

b) Give the general solution for this equation.
(Solve over the set of real numbers, giving exact value solutions.) **(1 mark)**

15. (aug03-08)

Prove the identity: **(5 marks)**

$$\frac{\cos\theta + \cot\theta}{1+\sin\theta} = \cot\theta$$

16. (jan04-06)

Solve algebraically, giving exact values, where $0 \le x < 2\pi$. **(4 marks)**

$$2\tan x \sin x - \tan x = 0$$

17. (jan04-07)

Prove the identity: **(4 marks)**

$$\frac{\cos x + \cot x}{\sec x + \tan x} = \cos x \cot x$$

18. (apr04-07)

Prove the identity: **(4 marks)**

$$\tan\theta\cos 2\theta + \tan\theta = \sin 2\theta$$

19. (jun04-07)

Prove the identity: **(4 marks)**

$$\csc\theta\sin 2\theta - \sec\theta\cos 2\theta = \sec\theta$$

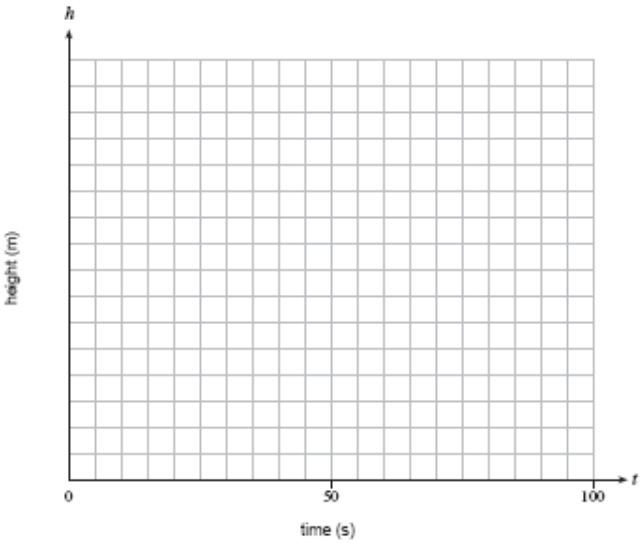
20. (aug04-06)

A sinusoidal curve has a minimum point at $\left(-\frac{\pi}{3}, -5\right)$ and the closest maximum point to the right is $\left(\frac{\pi}{6}, 3\right)$. Determine an equation of this curve. **(4 marks)**

21. (apr04-04)

A Ferris wheel with a radius of 30 m rotates once every 100 s. At time $t = 0$ s, passengers get on at the lowest point of its rotation which is 5 m above the ground.

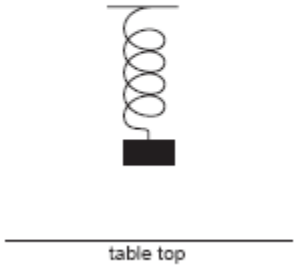
a) Using the grid below, graph how the height h of a passenger varies with respect to the elapsed time t during at least one rotation of the Ferris wheel. Clearly show at least 5 points on your graph and indicate the scale on the vertical axis. **(2 marks)**



b) Determine a sine function that gives the passenger's height h metres, above the ground as a function of time t seconds. **(2 marks)**

22. (jun04-06)

A mass is supported by a spring so that it rests 50 cm above a table top, as shown in the diagram below. The mass is pulled down to a height of 20 cm above the table top and released at time $t = 0$. It takes 0.8 seconds for the mass to reach a maximum height of 80 cm above the table top. As the mass moves up and down, its height h, in cm, above the table top, is approximated by a sinusoidal function of the elapsed time t, in seconds, for a short period of time.



Determine an equation for a sinusoidal function that gives h as a function of t. **(4 marks)**

23. (aug04-07)

Prove the identity: **(4 marks)**

$$\frac{1-\cos 2x}{\sin 2x} = \frac{1+\tan x}{1+\cot x}$$

24. (apr02-04)

Prove: **(5 marks)**

$$\frac{\sin 2x}{1+\cos 2x} = \frac{\sec^2 x - 1}{\tan x}$$