1. $\cot\Theta = \dfrac{19}{98}$ $\sec\Theta = \sqrt{\dfrac{1}{(\cot\Theta)^2}+1}$

$= \dfrac{\sqrt{9965}}{19}$

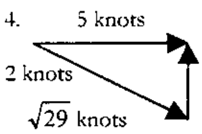
A

2. The period is not affected by the radical. (2π) E

3. $\sec^2 t = x^2$ $\tan^2 t = \dfrac{y^2}{9}$ $\dfrac{y^2}{9}+1 = x^2$

$x^2 - \dfrac{y^2}{9} = 1$ Hyperbola **D**

4. C



$\Theta = \tan^{-1}\dfrac{2}{5}$

5. D $\cos^2 x - 2\sin x\cos x + \sin^2 x = 2$

$\sin 2x = -1$ $x = \dfrac{3\pi}{4}$

6. B

$y = 5\sin t \therefore \dfrac{k}{m} = 5$ $a = -\dfrac{kx}{m}$

$a(3) = -5\sin 3$

7. A The complex fifth roots of unity form a regular pentagon inscribed in the unit circle. Its area is simply $5\dfrac{1}{2}\sin(72°) \approx 2.38$.

8. B Arbitrarily call A the "top" vertex of the tetrahedron. Give the projection of O onto triangle BDC the name O'. It should be clear that O' is the incenter of BDC. Call the length $O'B$ 2. This means that $AB = 2\sqrt{3}$ and therefore that $x = AO' = 2\sqrt{2}$. Now solve $x^2 = (2\sqrt{2}-x)^2 + 4$ to get $OB = \dfrac{3\sqrt{2}}{2}$.

Finally, call theta the angle we are looking for.

$$\Theta = \pi - \sin^{-1}\left(\frac{O'B}{OB}\right) = \pi - \sin^{-1}\left(\frac{2\sqrt{2}}{3}\right).$$

9. C The axes are rotated through $\dfrac{\pi}{4}$ radians to satisfy these conditions.

10. C Let a be the length of AB.

$\tan\Theta = \dfrac{1}{a}$ $a = \cot\Theta$

11. B $x = \dfrac{\tan 40° - x}{1 + x\tan 40°}$

$x = \tan(40° - \tan^{-1} x)$

$2\tan^{-1} x = 40°$

$x = \tan 20°$

12. A $c\sin A = 9\sqrt{2} \approx 12.73$

This is greater than 10, so there are no triangles.

13. A $\csc^2\Theta = \cot^2\Theta + 1$ $2x = \tan\Theta$

$\sin^2\Theta = \dfrac{1}{\dfrac{1}{(2x)^2}+1}$ $\sin\Theta = \dfrac{2x}{\sqrt{4x^2+1}}$

14. C $\cos\left(\dfrac{\pi}{2} - x\right) = \sin x$

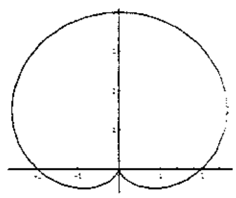
$\sin(2x + \dfrac{\pi}{2}) = \cos 2x$

15. D $\cos(a+b) + \cos(a-b) = 2\cos a\cos b$

$\cos 5\Theta\cos 2\Theta = \dfrac{\cos 7\Theta + \cos 3\Theta}{2} = \dfrac{1+\dfrac{1}{2}}{2} = \dfrac{3}{4}$

16. A $\sin 7\Theta\cos 2\Theta - \sin 2\Theta\cos 7\Theta = \sin 5\Theta$

17. D $r = 2(1+\sin\Theta)$



18. C

$\sec^2\Theta - 1 = \tan^2\Theta$ $\dfrac{2\sin\Theta\cos\Theta}{1-2\sin^2\Theta} = \tan 2\Theta$

$\dfrac{2(1-\cos^2\Theta)}{2\cos^2\Theta} = \tan^2\Theta$ $\tan\Theta\tan(\Theta+\pi) = \tan^2\Theta$

19. C

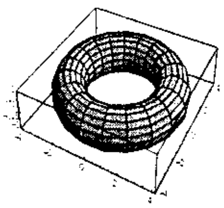
$\cos 3\Theta + i\sin 3\Theta = \cos^3\Theta + 3\cos^2\Theta\sin\Theta i - 3\cos\Theta\sin^2\Theta - i\sin^3\Theta$

Comparing coefficients gives us:

$\sin 3\Theta = 3\cos^2\Theta\sin\Theta - \sin^3\Theta$

20. C 400 knots. This is a 3-4-5 based right triangle.

21. D Careful analysis of the equations reveals that the surface resembles a doughnut. This kind of surface is called a torus. As the radius of a locus of circles ranges from r+a to r-a and back, the height of the circles varies, resulting in this three dimensional surface.

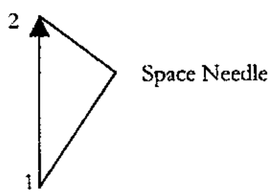


22. A
$$r(19\cos\Theta + 98\sin\Theta) = 250$$
$$r = \frac{250}{19\cos\Theta + 98\sin\Theta}$$

23. D $\sin 2\Theta = \frac{\sqrt{3}}{2}$ *and* $\cos 2\Theta = \frac{1}{2} \therefore \Theta = \frac{\pi}{6}$

24. B
$$y = \frac{16}{\pi}\sin\frac{\pi}{16}x$$
$$y(4) = \frac{8\sqrt{2}}{\pi}$$

25. B



From 1 to 2, the plane travels $\frac{500}{120}$ miles. The triange is 30-60-90, so its area is $\frac{1}{2}\left(\frac{500}{120}\frac{1}{2}\right)\left(\frac{500}{120}\frac{\sqrt{3}}{2}\right)$. Thus, the perpendicular distnace is the area divided by the distance times 2: about 1.8 miles.

26. A $\tan\frac{C}{2} = \frac{\sin C}{1+\cos C} = \frac{\frac{t}{a}}{1+\frac{m}{a}} = \frac{t}{m+a}$

27. E The specificed angle is in radians, so none of these degree angles are coterminal.

28. C Choices I and III are equal to $\sqrt{1-\frac{v^2}{c^2}}$. The remaining choices are equivalent to $\sqrt{1+\frac{v^2}{c^2}}$.

29. E
$$a = \tan\Theta$$
$$a^2 + 1 = 9 - 2a$$
$$a^2 + 2a - 8 = 0$$
$$a = -4 \text{ or } 2$$
$$\Theta = \{\tan^{-1}2, \tan^{-1}-4, \tan^{-1}2+\pi, \tan^{-1}-4+\pi\}$$

30. A
$$w(\Theta) = (\cos\Theta, \sin\Theta)$$
$$\cos^2\Theta + \sin^2\Theta = 1$$