1. **[E]** $\tan\frac{3\pi}{2}=\frac{\sin\frac{3\pi}{2}}{\cos\frac{3\pi}{2}}=\frac{-1}{0}$. The value is undefined.

2. **[B]** Keep adding $360°$ to find a coterminal angle. $\sin(-400°)=\sin(-40)°=-\sin(40°)$ (remember, the sine function is odd.) Referring to the table, $-\sin(40°)=-0.6428$.

3. **[B]** Converting to degrees, $\frac{\pi}{10}=\frac{x}{180°} \rightarrow x=18°$. Of course, the cofunction identity for sine states that $\cos(18°)=\sin(90°-18°)=\sin(72°)$. Referring to the table, $\sin(72°)=0.9511$.

4. **[A]** By Euler's formula, $\text{cis}\,\theta=e^{i\theta}$. So, $\text{cis}(x+y)=e^{i(x+y)}=e^{xi+yi}=\left(e^{xi}\right)\left(e^{yi}\right)=\text{cis}(x)\,\text{cis}(y)$.

5. **[C]** Since $\sin(2x)=2\sin(x)\cos(x)$, it is negative if either $\sin x<0$ or $\cos x<0$. We know that $\sec x>0 \rightarrow \cos x>0$ and $\csc x<0 \rightarrow \sin x<0$. The double cosine identities are irrelevant here because if $x=-45°$, then the conditions given apply but $\cos(2x)=0$.

6. **[C]** Rewriting, $y=-2\sin(3[x+2])+3$. The amplitude is $|-2|=2$. The period is $\frac{2\pi}{3}$. $\left|2(2)+3\left(\frac{2}{3}\right)\right|=6$.

7. **[B]** The area of the triangle = $\frac{1}{2}(6)(10)(\sin 58°)=30\sin(58°)$. Use the table. $30\sin(58°)=30(0.848)=25.44$.

8. **[A]** $\text{Sin}^{-1}\left(\sin\left(\frac{5\pi}{3}\right)\right)=\text{Sin}^{-1}\left(-\frac{\sqrt{3}}{2}\right)=-\frac{\pi}{3}$

9. **[A]** Converting to a fraction, $\csc\lambda=2.6=\frac{26}{10}=\frac{13}{5}$. Then $\sin\lambda=\frac{5}{13}$ and $\cos\lambda=\frac{12}{13}$. So $\tan\lambda=\frac{\sin\lambda}{\cos\lambda}=\frac{5}{12}$.

10. **[B]** Since the angles of a triangle sum to $180°$, $m\angle C=61°$. Using the Law of Sines, $\frac{\sin A}{a}=\frac{\sin C}{c}$. $\frac{\sin 37°}{a}=\frac{\sin 64°}{10}$ Using the table, then $\frac{0.6018}{a}=\frac{0.8988}{10}$. Cross-multiplying, and rounding to 2 decimal places, $0.9a=6 \rightarrow 9a=60 \rightarrow a=6.\overline{6}$, which rounds to 7.

11. **[A]** Manipulating the identity $1+\tan^2\theta=\sec^2\theta$, $1-\sec^2\theta=-\tan^2\theta$.

12. **[C]** Factoring, $(2\sin x+1)(\sin x+1)=0$. The first factor solves to $x=-\frac{1}{2}$ and the second solves to $\sin x=-1$. The possible values are $\left\{\frac{7\pi}{6},\frac{3\pi}{2},\frac{11\pi}{6}\right\}$. The sum is $\frac{9\pi}{2}$, and the mean is $\frac{9\pi}{2}\div 3=\frac{3\pi}{2}$.

13. **[D]** $\tan\theta=\frac{y}{x}$, so $y=x\tan\theta$.

14. **[C]**
$\sin(3x)=\sin(2x+x)=\sin(2x)\cos(x)+\cos(2x)\sin(x)=2\sin x\cos^2 x+(1-2\sin^2 x)(\sin x)=$
$2\left(\frac{2}{5}\right)\left(\frac{\sqrt{21}}{5}\right)^2+\left(1-2\left(\frac{2}{5}\right)^2\right)\left(\frac{2}{5}\right)=\left(\frac{4}{5}\right)\left(\frac{21}{25}\right)+\left(\frac{2}{5}-2\left(\frac{2}{5}\right)^3\right)=\frac{84}{125}+\left(\frac{50}{125}-\frac{16}{125}\right)=\frac{118}{125}$.

15. **[C]** First, determine that the triangle is not degenerate. Since $\sqrt{5}$ is between 2 and 3, then $3\sqrt{5}$ is between 8 and 12. Then $4\sqrt{3}=8\frac{\sqrt{3}}{2}=8\sin(60°)\approx 6.93$. So 12 is the largest side, and the smaller sides have a sum large enough to guarantee a triangle.

Second, the Pythagorean Inequality Theorem states that a triangle with sides a, b, and c where $a \le b \le c$ is obtuse iff $a^2+b^2<c^2$; right iff $a^2+b^2=c^2$; and acute iff $a^2+b^2>c^2$. Since $\left(4\sqrt{3}\right)^2+\left(3\sqrt{5}\right)^2=48+45=93$ is less than $12^2=144$, the triangle is obtuse.

16. **[B]** The range is $[0,\pi]$ and the domain is $[-1,1]$. The union is all numbers that lie in either or both intervals, and is $[-1,\pi]$.

17. **[A]** Law of Cosines! $6^2=5^2+9^2-2(5)(9)\cos J \;\rightarrow\; -70=-90\cos J \;\rightarrow\; \cos J=\frac{7}{9}$. There are no cosines on the table, but use your cofunction knowledge. Note from the table that $\text{Sin}^{-1}\left(\frac{7}{9}\right)\approx \text{Sin}^{-1}(0.778)$ is between $51°$ and $52°$. So $\text{Cos}^{-1}\left(\frac{7}{9}\right)$ is between $38°$ and $39°$.

18. **[E]** Since $\sec\alpha$ is positive, α is in Quadrant IV. $\cos\alpha=\frac{4}{5}$ and $\sin\alpha=-\frac{3}{5}$. Similarly, β is in Quadrant II. So $\cos\beta=-\frac{4}{5}$. $\cos(\alpha-\beta)=\cos\alpha\cos\beta+\sin\alpha\sin\beta=\left(\frac{4}{5}\right)\left(-\frac{4}{5}\right)+\left(-\frac{3}{5}\right)\left(\frac{3}{5}\right)=-1$

19. **[C]** $\sin(x)\ge\frac{1}{2}$ only on the interval $\left[\frac{\pi}{6},\frac{5\pi}{6}\right]$, which is $\frac{5\pi}{6}-\frac{\pi}{6}=\frac{2\pi}{3}$ units long. The probability that a value is greater than or equal to $\frac{1}{2}$ is $\frac{\frac{2\pi}{3}}{2\pi}=\frac{1}{3}$, so the probability that the value is less than $\frac{1}{2}$ is $1-\frac{1}{3}=\frac{2}{3}$.

20. **[C]** Note that $\sin(2x)=\frac{24}{25}\rightarrow\cos(2x)=\frac{7}{25}\rightarrow\cos^2(x)-\sin^2(x)=\frac{7}{25}$. Let's square it.

$\cos^4(x)-2\sin^2(x)\cos^2(x)+\sin^4(x)=\frac{49}{625}$. Now, note that

$\sin(2x)=\frac{24}{25}\;\rightarrow\;2\sin x\cos x=\frac{24}{25}\;\rightarrow\;\sin x\cos x=\frac{12}{25}\rightarrow\sin^2(x)\cos^2(x)=\frac{144}{625}$. Substituting,

$\cos^4(x)+\sin^4(x)-2\left(\frac{144}{625}\right)=\frac{49}{625}$, and then $\sin^4(x)+\cos^4(x)=\frac{337}{625}$.

21. **[D]** $42'01''$ is very very slightly more than 42 minutes, which is very very slightly more than $\frac{42}{60}\approx 0.7°$

22. **[A]** $\frac{(1+\cos y)(1-\cos y)}{\tan y \csc y - \cos y} = \frac{(1-\cos^2 y)}{\frac{\sin y}{\cos y}\bullet\frac{1}{\sin y} - \cos y} = \frac{1-\cos^2 y}{\frac{1}{\cos y} - \frac{\cos^2 y}{\cos y}} =$

$$\frac{\frac{1-\cos^2 y}{1}}{\frac{1-\cos^2 y}{\cos y}} = \frac{1-\cos^2 y}{1}\bullet\frac{\cos y}{1-\cos^2 y} = \cos y$$

23. **[D]** Converting to degrees, $2\,\text{cis}\left(\frac{3\pi}{15}\right) = 2\,\text{cis}(36°) = 2\cos(36°) + 2i\sin(36°)$, which by cofunction identity is $2\sin(54°) + 2i\sin(36°)$. Referring to the table, this is approximately $1.6 + 1.2i$, so $|a+2b|$ is approximately 4.

24. **[B]** Let's change both graphs to a positive sine with a shift. $-\sin(x-\pi) = \sin(x)$, and $\cos\left(\frac{\pi}{2}+x\right) = \sin\left(\frac{\pi}{2}+\left(\frac{\pi}{2}-x\right)\right) = \sin(-x) = \sin(x-\pi)$.

25. **[D]** The dodecagon can be divided into 24 congruent right triangles. In each, the angle at the center is $\frac{360°}{24} = 15°$, and the angle at the vertex is $75°$. The short side of the triangle is ($0.5x$) and to find the height the trig ratio $\tan(75°) = \frac{h}{0.5x}$ is solved. $h = 0.5\tan(75°)$. The area of the triangle is $\left(\frac{x^2}{8}\right)\tan 75°$. There are 24 of these triangles comprising the dodecagon, so the total area is $3x^2 \tan 75°$.

26. **[C]** The radicand is read whenever $\sin x \ge \cos x$. Since $\sin x = \cos x$ only at the values $\frac{\pi}{4}$ and $\frac{5\pi}{4}$, then plot those values on a number line and test the intervals. The solution set lies between (and includes) them.

27. **[A]** $\tan(2\beta) = \frac{2\tan\beta}{1-\tan^2\beta} = \frac{2\left(\frac{12}{5}\right)}{1-\left(\frac{12}{5}\right)^2} = \frac{\frac{24}{5}}{\frac{25}{25}-\frac{144}{25}} = \left(\frac{24}{5}\right)\left(-\frac{25}{119}\right) = -\frac{120}{119}$

28. **[C]** I is not true, because sine is an odd, not an even, function. II is true. Since $0 \le |\cos x| \le 1$ for all x, squaring $\cos(x)$ will not increase its value. III is true because $(\sin x + \cos x)^2 = \sin^2 x + \cos^2 x + 2\sin x\cos x = 1 + \sin(2x)$.

29. **[C]** The amplitude of either function is irrelevant, since there is no vertical shift involved. The graphs of sine and cosine intersect twice on the interval; doubling the frequency of cosine will double the number of intersection points.

30. **[D]** Looking at the first six terms, $\frac{1}{2}-\frac{1}{2}-1-\frac{1}{2}+\frac{1}{2}+1=0$. After this, the period repeats. Dividing 2007 by 6 and looking at the remainder, only three terms remain after the final period. $\left(\frac{1}{2}-\frac{1}{2}-1\right)^2 = 1$