1) If the function $f(x) = -5\cos(3x - \frac{\pi}{4})$, has amplitude A, period P, and horizontal shift S, then

A) $A = 5$, $P = \frac{2\pi}{3}$, $S = \frac{\pi}{12}$ to the right

B) $A = -5$, $P = \frac{2\pi}{3}$, $S = \frac{\pi}{12}$ to the left

C) $A = 5$, $P = 2\pi$, $S = \frac{\pi}{12}$ to the left

D) $A = 5$, $P = \frac{2\pi}{3}$, $S = \frac{\pi}{4}$ to the right

E) $A = 5$, $P = \frac{\pi}{3}$, $S = \frac{\pi}{4}$ to the left

2) The equation of the figure below is:

A) $y = -6\sin(\frac{1}{2}x - \frac{\pi}{2})$

B) $y = 6\sin(\frac{1}{2}x - \frac{\pi}{2})$

C) $y = -6\cos(\frac{1}{2}x - \frac{\pi}{2})$

D) $y = 6\cos(2x - \frac{\pi}{2})$

E) $y = -6\sin(2x - \frac{\pi}{2})$

3) If $x = a$ and $x = b$ are the vertical asymptotes of the graph of $y = 5 \cot (3x + \frac{\pi}{3})$ in the interval $(-\frac{\pi}{3}, \frac{\pi}{3})$, then $a + b =$

A) $\frac{\pi}{9}$

B) $-\frac{2\pi}{9}$

C) $-\frac{\pi}{4}$

D) $\frac{2\pi}{3}$

E) $\frac{4\pi}{9}$

4) The range of the function $y = \frac{\pi}{3} + \frac{1}{2}\sin^{-1}\left(x - \frac{\pi}{3}\right)$ is:

A) $[\frac{\pi}{12}, \frac{7\pi}{12}]$

B) $[\frac{\pi}{3} - \frac{1}{2}, \frac{\pi}{3} + \frac{1}{2}]$

C) $(-\infty, \frac{\pi}{3} - \frac{1}{2}] \cup [\frac{\pi}{3} + \frac{1}{2}, \infty)$

D) $[-\frac{\pi}{3}, \frac{\pi}{3}]$

E) $(-\infty, \frac{\pi}{12}] \cup [\frac{7\pi}{12}, \infty)$

5) $\sin^{-1}(\sin\frac{7\pi}{5}) =$

A) $-\frac{2\pi}{5}$

B) $\frac{2\pi}{5}$

C) $-\frac{7\pi}{5}$

D) $\frac{\pi}{5}$

E) $\frac{7\pi}{5}$

6) $\tan\theta + \frac{1}{\sec\theta + \tan\theta} =$

A) $\sec\theta$

B) $\cos\theta$

C) $1 + \sin\theta$

D) 1

E) $\sin\theta$

7) $\cos 975^\circ =$

A) $\frac{\sqrt{2} - \sqrt{6}}{4}$

B) $\frac{\sqrt{2} + \sqrt{3}}{2}$

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

D) $\frac{\sqrt{2} + \sqrt{3}}{4}$

E) $\frac{\sqrt{2} + \sqrt{6}}{4}$

8) $\cos \frac{3\pi}{5} \sin \frac{\pi}{10} - \sin \frac{3\pi}{5} \sin \frac{2\pi}{5} =$

A) -1

B) 1

C) $\frac{3}{5}$

D) $-\frac{3}{5}$

E) 0

9) The maximum value M and period P of the function $f(x) = 3 \sin(\frac{x}{2}) + 3\sqrt{3} \cos(\frac{x}{2})$ is:

A) $M = 6$, $P = 4\pi$

B) $M = 3\sqrt{3}$, $P = 2\pi$

C) $M = 6$, $P = 2\pi$

D) $M = 9\sqrt{3}$, $P = 4\pi$

E) $M = 3$, $P = 4\pi$

10) The expression $\sin(\cos^{-1}\frac{2}{3} - \tan^{-1}\sqrt{3})$ simplifies to:

A) $\frac{\sqrt{5} - 2\sqrt{3}}{6}$

B) $\frac{\sqrt{5} + 2\sqrt{3}}{6}$

C) $\frac{\sqrt{15} - 2}{6}$

D) $\frac{\sqrt{15} + 2}{6}$

E) $\frac{\sqrt{5} + \sqrt{3}}{6}$

11) $\cot \frac{x}{2} - \cos x \cot \frac{x}{2} =$

A) $\sin x$

B) $\csc x$

C) $\tan x$

D) $\sec x$

E) $\cos x$

12) The exact value of the expression $\left(\sin \frac{\pi}{12} - \cos \frac{\pi}{12}\right)^2$ is:

A) $\frac{1}{2}$

B) $\frac{3}{2}$

C) $-\frac{1}{2}$

D) $-\frac{3}{2}$

E) 0

13) The sum of all the zeros of $f(x) = \cos 2x - \cos x$ in $[0, 2\pi)$ is:

A) 2π

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

C) 4π

D) $\frac{4\pi}{3}$

E) π

14) The number of solutions of $\cos\theta \sin\theta = 2\cos\theta \quad 0 \leq \theta < \frac{5\pi}{2}$, is:

A) 2

B) 3

C) 1

D) 0

E) 4

15) If $f(x) = a \tan(bx)$, has period $\frac{3}{2}$ and $f\left(\frac{3}{8}\right) = -1$, then $\pi a + b =$

A) $-\frac{\pi}{3}$

B) $-\frac{\pi}{6}$

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

D) $-\frac{\pi}{4}$

E) $\frac{\pi}{6}$

16) The sum of all the solutions of $\cos\theta - \sin\theta = \sqrt{2}\sin\frac{\theta}{2}$, $0 \le \theta < 2\pi$ is:

A) $\frac{5\pi}{3}$

B) $\frac{13\pi}{6}$

C) $\frac{5\pi}{2}$

D) $\frac{17\pi}{6}$

E) $\frac{3\pi}{2}$

17) If $u = \langle -\sqrt{3}, -1 \rangle$ and $v = i + 3\sqrt{3}\, j$ are two vectors, then the direction of the vector $w = \sqrt{3}\, u + v$ is:

A) 120°

B) 210°

C) 150°

D) 330°

E) 240°

18) Let u be a vector of magnitude 2 and direction 120° and $v = \langle a, \sqrt{3} \rangle$. If u and v are orthogonal vectors, then $a =$

A) 3

B) - 3

C) 2

D) - 2

E) 1

19) If θ is the smallest positive angle between the vectors $u = 3i - 4j$ and $v = -2i + j$ then $\tan\theta =$

A) $-\frac{1}{2}$

B) $\frac{\sqrt{5}}{2}$

C) $\frac{1}{2}$

D) $\frac{2\sqrt{5}}{5}$

E) -2

20) If (a, b) is the minimum point on the the graph of the function $f(x) = -2\sec(\frac{1}{2}\pi x + \pi)$, $3 < x < 5$, then $a + b =$

A) 6

B) 2

C) -2

D) π

E) 0