1) $\sin\left(2\sec^{-1}\frac{5}{3}\right) =$

A) $\frac{24}{25}$

B) $\frac{17}{25}$

C) $\frac{7}{25}$

D) $-\frac{24}{25}$

E) $-\frac{17}{25}$

2) The reference angle of $\theta = 10$, is

A) $10 - 3\pi$

B) $4\pi - 10$

C) $10 + 3\pi$

D) $10 - 4\pi$

E) $3\pi - 10$

3) If u is a vector of magnitude $8\sqrt{2}$ and direction 135° and $v = 3i - 2j$, then the vertical component of the vector $w = u + 2v$, is

A) 4

B) - 4

C) - 2

D) 6

E) 2

4) If $x = a$ and $x = b$ are the vertical asymptotes of the graph of $y = 2\tan\left(\frac{x}{3} + \frac{\pi}{6}\right)$ in the interval $(-\pi, 4\pi]$, then $a + b =$

A) 5π

B) 4π

C) 3π

D) π

E) 2π

5) If $\sin\alpha = \frac{4}{5}$, $0 < \alpha < \frac{\pi}{2}$ and $\cos\beta = -\frac{5}{13}$, $\frac{\pi}{2} < \beta < \pi$, then $\tan(\alpha - \beta) =$

A) $-\frac{56}{33}$

B) $-\frac{33}{56}$

C) $-\frac{33}{65}$

D) $-\frac{65}{33}$

E) $\frac{33}{65}$

6) The exact value of $\tan(607.5^\circ)$, is

A) $\sqrt{2} + 1$

B) $-\sqrt{3} - 3$

C) $-\sqrt{2} + 1$

D) $-\sqrt{2} - 1$

E) $\sqrt{2} - 1$

7) If the function $y = \frac{1}{2}\sin(\frac{1}{2}x) - \frac{\sqrt{3}}{2}\cos(\frac{1}{2}x) + \frac{11}{2}$ is written in the form $y = k\sin(bx + \alpha) + c$, then $k + b + c =$

A) 7

B) 6

C) 5

D) 4

E) 9

8) If the graph of the function $f(x) = a\tan(bx + c)$ has a period of $\frac{1}{4}$, a horizontal shift of $\frac{1}{2}$ to the right , and $f(\frac{7}{12}) = -\sqrt{3}$, then $\pi a + b =$

A) 3π

B) 5π

C) -2π

D) 7π

E) 2π

9) If $\cos\theta = \frac{3}{5}$ and $\sin\theta < 0$, then $\tan 2\theta =$

A) $\frac{24}{7}$

B) $-\frac{4}{7}$

C) $-\frac{12}{7}$

D) 12

E) $\frac{4}{7}$

10) Let P be the period of $y = -2\tan(2x + \pi)$. If A is the amplitude, and S is the horizontal shift of $y = -2\cos(3x + 6)$, then $A + P + S =$

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

B) $4 + \frac{\pi}{3}$

C) $4 - \frac{\pi}{3}$

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

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

11) The domain of the function $y = \frac{\pi}{2} + 2\sin^{-1}\left(\frac{3}{2}x - \frac{5}{2}\right)$, is

A) $[1, \frac{7}{3}]$

B) $[\pi, \frac{7\pi}{3}]$

C) $(-\infty, \frac{-\pi+5}{3}] \cup [\frac{\pi+5}{3}, \infty)$

D) $[\frac{-\pi+5}{3}, \frac{\pi+5}{3}]$

E) $(-\infty, 1] \cup [\frac{7}{3}, \infty)$

12) The expression $\frac{1}{\csc x + \cot x} + \frac{1}{\csc x - \cot x}$ simplifies to

A) $2\csc x$

B) $2\tan x$

C) $2\sec x$

D) $2\sin x$

E) $2\cos x$

13) Let $u = 2i + j$, $v = -2i + 3j$, and $w = 3i + 4j$ be three vectors.
If $t = u \cdot v$, then the magnitude of $t\,w$ is equal to

A) 5

B) 2

C) 3

D) - 5

E) - 3

14) $\dfrac{\sin(\alpha - \beta)}{\cos\alpha \cos\beta} =$

A) $\tan\alpha - \tan\beta$

B) $\tan\alpha \tan\beta$

C) $\sin\alpha - \cos\beta$

D) $\sin\alpha + \sin\beta$

E) $\tan\alpha + \tan\beta$

15) The graph of the function $y = -2\cos(\frac{\pi}{2}x)$, $0 \le x \le 4$, is above the x-axis on the interval

A) (1, 3)

B) $(0, 1) \cup (3, 4)$

C) $(3, 4)$

D) (0, 2)

E) (0, 4)

16) The graph of the function $y = 2\tan(2x - \frac{\pi}{2})$, $0 < x < \pi$, is below the x-axis on

A) $(0, \frac{\pi}{4}) \cup (\frac{\pi}{2}, \frac{3\pi}{4})$

B) $(\frac{\pi}{4}, \frac{\pi}{2}) \cup (\frac{3\pi}{4}, \pi)$

C) $(\frac{\pi}{4}, \frac{3\pi}{4})$

D) $(\frac{\pi}{4}, \frac{\pi}{2})$

E) $(0, \frac{\pi}{4}) \cup (\frac{3\pi}{4}, \pi)$

17) The exact value of $\cos\left(\frac{11\pi}{12} - \tan^{-1} 1\right)$, is

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

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

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

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

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

18) The number of solutions of $\csc^2 x - 2\cot x = 0$, $0 \le x < 2\pi$, is

A) 2

B) 4

C) 3

D) 6

E) 5

19) The sum of all solutions of the equation

$2\cos^2 x = \sqrt{3} + 2\sin^2 x$, $0 < x < \pi$, is

A) π

B) $\frac{11\pi}{6}$

C) 3π

D) 2π

E) $\frac{7\pi}{6}$

20) If $y = a\csc(bx + c)$, $-\frac{\pi}{2} \le c < 0$, represents the curve below,

then $a \cdot b \cdot c =$

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

B) -2π

C) 3π

D) 2π

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