1) A belt runs two pulleys of radii 20 cm and 15 cm. If the smaller pulley makes 3π radians in 15 seconds, then the angular speed of the larger pulley in radians per second is

A) $\frac{3\pi}{20}$

B) 9π

C) 30π

D) $\frac{15\pi}{2}$

E) $\frac{3\pi}{10}$

2) The exact value of $\cot\left(-\frac{13\pi}{6}\right) + \csc\left(\frac{23\pi}{3}\right)$ is equal to

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

B) $\frac{5\sqrt{3}}{3}$

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

D) $\frac{\sqrt{3}}{3}$

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

3) The graph of $y = 2\cos(\frac{\pi}{6}x)$, with $-6 \le x \le 6$,

A) is decreasing on the interval $[0, 6]$

B) is increasing on the interval $[0, 6]$

C) has three x-intercepts on the interval $[-6, 6]$

D) is decreasing on the interval $[-6, 0]$

E) intersects the y-axis at $(0, 1)$

4) Which one of the following statements is TRUE about the function

$f(x) = -1 + \frac{1}{2}\sin(2x - 3\pi)$?

A) The range of the function is $[-\frac{3}{2}, -\frac{1}{2}]$

B) The vertical translation of the graph of the function is $\frac{1}{2}$ unit up

C) The period of the function is 2π

D) The phase shift of the function is 3π unit to the right

E) The amplitude of the function is $\frac{3}{2}$

5) If the graph in the figure below represents the function $y = a - \cot(bx + c)$ over $(\pi, 3\pi)$, then $a + 2b + \frac{2}{\pi}c =$

A) 0

B) π

C) $-\pi$

D) 2π

E) -2π

6) The number of vertical asymptotes of the function $y = 2 + 3\csc(2x - \pi)$ in the interval $[-\pi, \pi]$ is ?

A) 5

B) 4

C) 3

D) 2

E) 6

7) If x is in the third quadrant, then $\cot x$ in terms of $\sec x$ is

A) $\dfrac{\sqrt{\sec^2 x - 1}}{\sec^2 x - 1}$

B) $-\dfrac{\sqrt{\sec^2 x - 1}}{\sec^2 x - 1}$

C) $-\dfrac{\sqrt{\sec^2 x + 1}}{\sec^2 x - 1}$

D) $\dfrac{\sqrt{\sec^2 x - 1}}{\sec^2 x + 1}$

E) $-\dfrac{1}{\sec^2 x - 1}$

8) $\dfrac{\sin\theta}{1 - \cot\theta} + \dfrac{\cos\theta}{1 - \tan\theta} =$

A) $\sin\theta + \cos\theta$

B) $\sin\theta - \cos\theta$

C) $-\sin\theta + \cos\theta$

D) $-\sin\theta - \cos\theta$

E) $\cos\theta$

9) $\sin(\frac{\pi}{6} + \theta) + \cos(\frac{\pi}{3} + \theta) =$

A) $\cos\theta$

B) $\sin\theta$

C) $\sin\theta + \cos\theta$

D) $\sin\theta + \cos\theta + 1$

E) $\sin\theta\cos\theta$

10) If $\sin\theta = \frac{3}{5}$ and $\frac{\pi}{2} < \theta < \pi$, then $\tan\frac{\theta}{2} =$

A) 3

B) 4

C) $\sqrt{3}$

D) $-\sqrt{3}$

E) $\frac{1}{3}$

11) $\dfrac{\tan 73^\circ - \cot 257^\circ}{1 - \tan(-73)^\circ \cot 257^\circ} =$

A) $\sqrt{3}$

B) $-\sqrt{3}$

C) $\dfrac{\sqrt{3}}{3}$

D) $-\dfrac{\sqrt{3}}{3}$

E) -1

12) The range of the function $f(x) = -2\sin x - \sqrt{5}\cos x - 4$ is

A) $[-7, -1]$

B) $[-4, 4]$

C) $[-\sqrt{5}, -1+\sqrt{5}]$

D) $[0, 1+\sqrt{5}]$

E) $[-2, 2]$

13) $\frac{1}{4} - \frac{1}{2}\sin^2 67.5^o =$

A) $-\frac{\sqrt{2}}{8}$

B) $-\frac{\sqrt{3}}{8}$

C) $\frac{\sqrt{3}}{8}$

D) $\frac{\sqrt{2}}{8}$

E) $\frac{\sqrt{6}}{8}$

14) If $\cos 2x = \frac{1}{3}$ and $\frac{\pi}{2} < x < \pi$, then $\cos x =$

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

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

C) $-\frac{1}{3}$

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

E) $-\frac{\sqrt{6}}{2}$

15) $\sin\left(2\operatorname{arcsec}\frac{3}{2}\right) =$

A) $\frac{4\sqrt{5}}{9}$

B) $\frac{1}{9}$

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

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

E) $-\frac{2}{9}$

16) $\frac{1}{2}\cot\frac{x}{2} - \frac{1}{2}\tan\frac{x}{2} =$

A) $\cot x$

B) $\tan x$

C) $\cos x$

D) $\csc x$

E) $\sin x$

17) $\cos\left(\frac{\pi}{4} + \tan^{-1}\frac{3}{4}\right) =$

A) $\frac{\sqrt{2}}{10}$

B) $\frac{\sqrt{3}}{10}$

C) $\frac{\sqrt{2}}{4}$

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

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

18) If $0 \le x < 2\pi$, then the sum of all the solutions of the equation $\cos^2 x - \sin^2 x = 0$ is equal to

A) 4π

B) 2π

C) 3π

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

E) $\frac{7\pi}{2}$

19) The number of solution(s) of the equation $\tan x + \sqrt{3} = \sec x$ over the interval $[0, 360^\circ)$ is

A) One

B) Two

C) Three

D) Four

E) Five

20) If $\arcsin 2x + \arccos \frac{1}{3} = \pi$, then $x =$

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

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

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

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

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