1) If u is a vector of direction $\frac{2\pi}{3}$ and magnitude 5 , $v = 9i - 6\sqrt{3}j$,

then the magnitude of the vector $w = 2u + \frac{1}{3}v$, is equal to

A) $\sqrt{31}$

B) $\sqrt{11}$

C) $\sqrt{43}$

D) $\sqrt{17}$

E) $\sqrt{21}$

2)   The equation of the graph below is

A) $y = -2 \csc (\frac{1}{2}x - \frac{\pi}{4})$

B) $y = -2 \sec (\frac{1}{2}x - \frac{\pi}{4})$

C) $y = -2 \csc (2x - \frac{\pi}{4})$

D) $y = 2 \csc (\frac{1}{2}x - \frac{\pi}{4})$

E) $y = 2 \sec (2x - \frac{\pi}{4})$

3) If the function $f(x) = 1 - a \cos(bx - \pi)$, $a > 0$ has amplitude $\frac{2}{3}$, and

horizontal shift $\frac{\pi}{4}$ to the right, then $f\left(\frac{\pi}{12}\right) =$

A) $\frac{4}{3}$

B) $1 - \frac{\sqrt{3}}{3}$

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

D) $1 + \frac{\sqrt{3}}{2}$

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

4) The graph of the function $f(x) = -2 \sin(\pi x)$, $-1 < x < 2$, is below the x-axis on the interval

A)   (0, 1)

B)   (-1, 2)

C)   (- 1, 1)

D)   (1, 2)

E)   (0, 2)

5) If θ is the solution of the equation $\quad 2 \tan \theta + \sec^2 \theta = 4 \quad, \dfrac{3\pi}{2} < \theta < 2\pi$,

then $\cos \theta =$

A) $\dfrac{\sqrt{10}}{10}$

B) $\dfrac{\sqrt{5}}{5}$

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

D) $\dfrac{\sqrt{6}}{6}$

E) $\dfrac{\sqrt{2}}{2}$

6) $\quad \dfrac{\cos^2 \theta + \tan^2 \theta - 1}{\sin^2 \theta} =$

A) $\tan^2 \theta$

B) $\sec^2 \theta$

C) 1

D) $\csc^2 \theta$

E) $\cot^2 \theta$

7) If $u = \cos \dfrac{3\pi}{4} i + \sin \dfrac{3\pi}{4} j$ and $v = \langle 4k + 1, k - 3 \rangle$ are

perpendicular, then $k =$

A) $-\dfrac{4}{3}$

B) $\dfrac{5}{4}$

C) $\dfrac{4}{5}$

D) $\dfrac{2}{5}$

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

8) If the range of the function $f(x) = 3 + \sin(2x) + \dfrac{\sqrt{3}}{\sec(2x)}$ is $[m, n]$,

then $m + n =$

A) 6

B) 3

C) 10

D) 4

E) 8

9)   If $\dfrac{\sec x + \csc x}{\tan x + \cot x} = a \sin x + b \cos x$, then $a + b =$

    A)   2

    B)   1

    C)   3

    D)   4

    E)   0

10) $\sin^{-1}\left(\cos\left(\dfrac{5\pi}{11}\right)\right) =$

    A) $\dfrac{\pi}{22}$

    B) $\dfrac{5\pi}{11}$

    C) $\dfrac{20\pi}{11}$

    D) $\dfrac{\pi}{11}$

    E) $\dfrac{19\pi}{22}$

11)   The **number** of vertical asymptotes of the graph of the function

$y = 1 - \tan(2x + \frac{\pi}{2})$, over the interval $(-\pi, \pi]$, is equal to

A)   4

B)   2

C)   5

D)   3

E)   6

12) $\dfrac{4 \tan x}{2 - \sec^2 x} =$

A) $2 \tan 2x$

B) $2 \sec 2x$

C) $\tan 2x$

D) $4 \sec x$

E) $2 \tan x$

13) If $\csc(-\theta) = \dfrac{5}{3}$ and $\tan\theta < 0$, $0 < \theta < 2\pi$, then $\cos\dfrac{\theta}{2} =$

A) $-\dfrac{3\sqrt{10}}{10}$

B) $-\dfrac{\sqrt{10}}{2}$

C) $\dfrac{\sqrt{10}}{10}$

D) $\dfrac{3\sqrt{10}}{10}$

E) $-\dfrac{\sqrt{10}}{10}$

14) The smallest positive angle between the vectors $u = \langle -2, \ 2\sqrt{3} \rangle$ and
$v = -2\sqrt{3}\ i + 2j$, is

A) $30°$

B) $150°$

C) $60°$

D) $135°$

E) $120°$

15) The range of the function $\quad y = 2 - \left| 3 \cos (3x - \pi) \right|\quad$, is equal to

     A) $[-1, 2]$

     B) $[-3, 0]$

     C) $(-\infty, -3] \cup [0, \infty)$

     D) $[1, 4]$

     E) $(-\infty, 1] \cup [4, \infty)$

16) $\cos \left(\sin^{-1} \dfrac{\sqrt{3}}{2} + \cot^{-1} \sqrt{3} \right) =$

     A) 0

     B) $-\dfrac{\sqrt{2}}{2}$

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

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

     E) $-\dfrac{1}{2}$

17) If $\cos(2\alpha) = \dfrac{7}{25}$, $0 < \alpha < \dfrac{\pi}{2}$ and $\sin(2\beta) = -1$, $\dfrac{\pi}{2} < \beta < \pi$, then

$\tan(\alpha - \beta) =$

A)　　7

B)　　$\dfrac{1}{5}$

C)　　$-\dfrac{2}{5}$

D)　　10

E)　　5

18)　If $\left(\sin^2 \dfrac{x}{4}\right)\left(\cos^2 \dfrac{x}{4}\right) = a + b\cos x$, then $a \cdot b =$

A)　　$-\dfrac{1}{64}$

B)　　$-\dfrac{1}{36}$

C)　　$-\dfrac{1}{32}$

D)　　$-\dfrac{1}{48}$

E)　　$-\dfrac{1}{24}$

19) The sum of all the solutions of $\sin(\theta + \frac{\pi}{4}) + \sin(\theta - \frac{\pi}{4}) = -1$,

   $0 \le \theta < 2\pi$, is equal to

   A) 3π

   B) 5π

   C) π

   D) 4π

   E) $1.5\ \pi$

20) The sum of all the solutions of the equation
   $2 \sin \theta\ (\sin \theta - 1) = 3\ (\sin \theta + 1)$, $0 \le \theta < 360°$, is equal to

   A) $540°$

   B) $420°$

   C) $360°$

   D) $240°$

   E) $620°$