If none of the answers given are correct choose e) NOTA.

1. An angle has a measure of $\frac{-1100\pi}{7}$. In which quadrant does it lie?

a) I b) II c) III d) IV e) NOTA

2. Which of the following are rectangular coordinates of the polar point $(-3, \frac{2\pi}{3})$?

a) $(1.5, \frac{3\sqrt{3}}{2})$ b) $(\frac{3\sqrt{3}}{2}, -1.5)$
c) $(-1.5, \frac{3\sqrt{3}}{2})$ d) $(1.5, \frac{-3\sqrt{3}}{2})$ e) NOTA

3. In ΔABC, $a = 5$, $b = 5$, and $c = 6$. Find the area of the triangle to the nearest whole unit.

a) 16 b) 14 c) 12 d) 10 e) NOTA

4. $\sin(x) = \frac{a}{b}$, $0 < x < \frac{\pi}{2}$. $\sin(2x) =$

a) $\frac{2a\sqrt{b^2 - a^2}}{b^2}$ b) $\frac{2\sqrt{b^2 - a^2}}{ab}$
c) $\frac{2ab}{\sqrt{b^2 - a^2}}$ d) $\frac{2a\sqrt{a^2 - b^2}}{b^2}$ e) NOTA

5. $f(x) = |3\cos(x) - 1|$. Which of the following statements are true?

i) f is an even function.
ii) The period of f is 2π.
iii) $0 \le f(x) \le 3$.
iv) f has 2 zeroes over $(0, 2\pi)$.

a) i, iv b) i, ii, iv
c) i, ii, iii d) i, ii, iii, iv e) NOTA

6. Two sides and a diagonal of a parallelogram measure 7, 9, and 15 respectively. Find the measure of the smallest angle of the parallelogram to the nearest degree.

a) 36 b) 39 c) 41 d) 52 e) NOTA

7. $\cos(\theta + 30°) =$

a) $\frac{\sqrt{3}}{2}\sin\theta - \frac{1}{2}\cos\theta$
b) $\frac{\sqrt{3}}{2}\cos\theta + \frac{1}{2}\sin\theta$
c) $\frac{\sqrt{3}}{2}\sin\theta + \frac{1}{2}\cos\theta$
d) $\frac{\sqrt{3}}{2}\cos\theta - \frac{1}{2}\sin\theta$
e) NOTA

8. According to the Law of Sines which statements would be true? A,B, and C are the angles of a triangle and a, b, and c are the sides opposite those angles respectively.

i) $\frac{a-c}{c} = \frac{\sin A - \sin C}{\sin C}$ ii) $\frac{a}{b} = \frac{\sin B}{\sin A}$
iii) $\frac{b}{a+b} = \frac{\sin B}{\sin A + \sin B}$ iv) $\frac{c+b}{c} = \frac{\sin C + \sin B}{\sin C}$

a) i, ii, iii b) i, iii
c) ii, iii, iv d) i, ii, iiii, iv e) NOTA

9. A pendulum hangs on a 3.5 meter rod. Every three seconds the pendulum starts from center swings $5°$ left returns to the center, and then swings $5°$ right of center and returns to the center. To the nearest thousandth through how many meters does the pendulum swing in one hour?

a) 1.222 b) 488.692
c) 733.038 d) 1466.077 e) NOTA

10. $2\sin^2(x) - 2\sin^2(x)\cos(x) - \sin(x)\cos(x) + \sin(x) = 0$. Find the sum of the solutions over $[0, 4\pi]$. Do not include duplicate solutions.

a) $\frac{29\pi}{6}$ b) 10π c) $\frac{57\pi}{6}$ d) 20π e) NOTA

11. The Great Pyramid of Cheops in Egypt has a square base 250 meters on each side. The faces of the pyramid make an angle of $51^\circ 50'$ with the horizontal. To the nearest thousandth of a meter what is the shortest distance that you would have to climb up a face to reach the top?

a) 198.346 b) 202.281
c) 215.872 d) 259.451 e) NOTA

12. The smallest positive value of x for which the graph of the following has a vertical asymptote is $\frac{a\pi}{b}$, where a and b are relatively prime natural numbers. Find **a + b** if

$$y = \tan(3x + \tfrac{\pi}{4})$$

a) 5 b) 13 c) 15 d) 23 e) NOTA

13. Which of the following statements is false?

a) $\text{Sin}^{-1}(x) = -\text{Sin}^{-1}(-x)$
b) $\text{Sin}^{-1}(x) + \text{Cos}^{-1}(x) = \frac{\pi}{2}$
c) $\tan(\text{Tan}^{-1}(x)) = x$
d) $\text{Cos}^{-1}(x) = \text{Cos}^{-1}(-x)$
e) NOTA

14. $\frac{\tan(x)}{\sin(x)} = 2$, $0 < x < \frac{\pi}{2}$. Find the tenths digit of $\ln(x)$.

a) 0 b) 1 c) 3 d) 7 e) NOTA

15. The index of refraction (N) is equal to $\frac{\sin(\frac{a+b}{2})}{\sin(\frac{a}{2})}$, where the prism has an apex angle of a and an angle of deviation of b. Which of the following is an equivalent expression for N?

a) $\sqrt{\frac{1 + \cos(a)\cos(b) - \sin(a)\sin(b)}{1 - \cos(a)}}$
b) $\sqrt{\frac{1 - \cos(a)\cos(b) + \sin(a)\sin(b)}{1 - \cos(a)}}$
c) $\sqrt{\frac{1 - \cos(a+b)}{1 + \cos(a)}}$
d) $\sqrt{\frac{1 - \sin(a)\sin(b) + \cos(a)\cos(b)}{1 + \cos(a)}}$
e) NOTA

16. Find a + b in radians if $\tan(a) = P$, $\tan(b) = Q$, $(4P + 4)(3Q + 3) = 24$ and both a and b are in quadrant 1.

a) $\frac{\pi}{6}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{2}$ e) NOTA

17. $f(x) = 2\csc(\frac{\pi}{6}x - \frac{\pi}{2})$. Which of the following statements concerning f is false?

a) The domain of f is $\{x, x \in \text{Reals}, x \neq 3 + 6N, N \in \text{Integers}\}$.
b) The range of f is $f(x) \geq 2$ or $f(x) \leq -2$
c) The graph is shifted $\frac{\pi}{3}$ units to the right.
d) The period of f is 12.
e) NOTA

18. $\cot(A)\tan(2A) = 3$, $\frac{\pi}{2} \le A \le \pi$. Find the tenths digit of ln(A).

a) 2 b) 5 c) 6 d) 9 e) NOTA

19. An airplane flies on a compass heading of 340° at a speed of 650 mph. To the nearest mile how far north and how far west of the starting point is the plane after two hours?

a) 1222 north, 445 west
b) 611 north, 222 west
c) 222 north, 611 west
d) 445 north, 1222 west
e) NOTA

20. A hammer thrower whirls an iron ball in a circle at a constant height at the end of a handle which is 1 m long. If he can whirl it at 1.5 revolutions per second how fast is the ball traveling in meters per minute when it leaves his hand?

a) 3π b) 60π
c) 120π d) 180π e) NOTA

21. Which of the following statements about the polar graph of $r = 3\cos(2\theta)$ is false? The given points are in polar form.

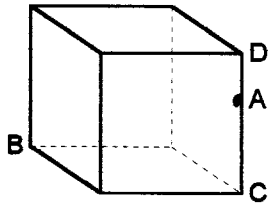
a) The graph is a 4-leaf rose.
b) (3, 0) and $(3, \pi)$ are horizontal intercepts.
c) $(-3, \frac{\pi}{2})$ and $(-3, \frac{3\pi}{2})$ are vertical intercepts.
d) The length of each leaf is 3.
e) NOTA

22. In ΔABC, A, B and C are angles and a, b and c are trespectively the sides opposite those angles .
Let X be the number of possible triangles if $A = 64^\circ$, $a = 8$, $b = 12$.
Let Y be the number of possible triangles if $A = 47^\circ$, $a = 10$. $b = 22$.
Let Z be the number of possible triangles if $A = 30^\circ$, $a = 2$, $b = 3$.

Find X + Y + Z.

a) 1 b) 2 c) 3 d) 4 e) NOTA

23. A cube has edges 3 feet. Point A is $\frac{2}{3}$ of the way from point vertex C to corner D.
Find the measure of $\angle ABC$ to the nearest tenth of a degree.



a) 25.2 b) 30
c) 40.9 d) 40.9 e) NOTA

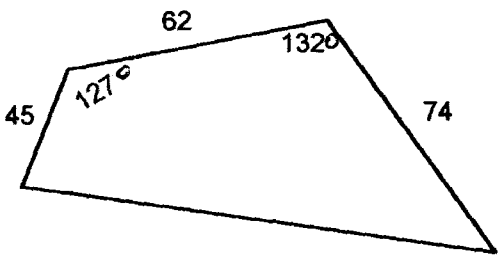
24. $(2\sin x + 3\cos x)^2 + (3\sin x - 2\cos x)^2 = A$.
What is the tenths digit of ln(A)?

a) 1 b) 3 c) 5 d) 7 e) NOTA

25. At a certain point on the beach a post sticks out of the sand, its top being 80 cm above the beach. The depth of the water at the post varies sinusoidally with time due to the motion of the tides. The depth d in centimeters is modeled by the equation $\mathbf{d = 40 + 60\cos(\frac{\pi}{6}t)}$, where t is the number of hours since midnight.. Let A be the first value of t, $t > 0$, to the nearest thousandth at which the water level is just at the top of the post. Find the tenths digit of ln(A).

a) 0 b) 3 c) 4 d) 7 e) NOTA

26. A field has the shape of the given quadrilateral below. Three sides measure 45, 62, and 74 meters and the given angles measure 127° and 132°. Find the area of the quadrilateral to the nearest square meter.



a) 1704 b) 2876
c) 4213 d) 4453 e) NOTA

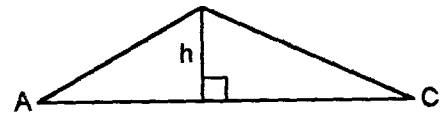
27. The domain of $f(x) = \ln(\sin 2(x - \frac{\pi}{4}))$ over $(0, 2\pi)$ is $(A, B) \cup (C, D)$.
Find A + B + C + D.

a) 2π b) $\frac{5\pi}{2}$ c) 3π d) 4π e) NOTA

28. The Cartesian equation $3x^2 + 4y^2 - 6x - 9 = 0$ can be written in polar form as

a) $r = \frac{3}{2 - \cos(\theta)}$
b) $3r^2\cos^2(\theta) + 4r^2\sin^2(\theta) + 6r\cos(\theta) - 9 = 0$
c) $4r^2\cos^2(\theta) - 3r^2\sin^2(\theta) - 6r\cos(\theta) - 9 = 0$
d) $r = \frac{2}{3 - \cos(\theta)}$
e) NOTA

29. In ΔABC find the length of h to the nearest whole number if AC = 20, BC = 12, and $\angle ABC = 125^\circ$ B



a) 5 b) 7 c) 9 d) 10 e) NOTA

30. A signal buoy in Tampa Bay bobs up and down with the height h of its transmitter in feet above sea level modeled by $h(t) = a\sin(bt) + 7$, where t is in seconds. During a small squall its height varies from 2 feet to 12 feet and there are 4.5 seconds from one 12 foot height to the next. The angle is measured in radians.
Find a + b to the nearest thousandth.

a) 5.716 b) 6.396
c) 11.396 d) 33.724 e) NOTA