1. Convert into rectangular coordinates: $1+tan^{2}\frac{θ}{2}$ = r
	1. y4 – 4y2 + 4xy2 = 0 b. x2 + y2 = 4 c. 4x2y = 1 – x

d. 2x2 – 2x + y2 = 0 e. NOTA

1. What is the equation of the circle that is tangent to the lines y=0, x=0, and 15y + 8x = 120?
	1. x2 – 4x + y2 – 4y + 4 = 0 b. x2 + y2 = 9

c. x2 + y2 – 6x– 6y + 9 = 0 d. x2 + y2 – 2x– 4y + 16 = 0 e. NOTA

1. Given quadrilateral ABCD (where points A and C are points on an ellipse, and points B and D are the on the foci of the ellipse). The ellipse is defined by the equation$ \frac{x^{2}}{9}+\frac{y^{2}}{ a^{2}}=1$, where |a| < 3. What is the perimeter of ABCD?
	1. 16 b. 12 c. 20 d. 4 e. NOTA
2. A truck that is 10 feet wide must pass through an elliptically-shaped tunnel with a base of 20 feet and a maximum height of 30 feet. What is the greatest height the truck can have and still fit through the tunnel?
	1. $15\sqrt{3}$ b. 14 c. 17 d. $ 13\sqrt{5}$ e. NOTA
3. What is the length of a petal in the rose curve $r=8cosθsinθ$?
	1. 12 b. 16 c. 4 d. 2 e. NOTA
4. How many paths can you take from the point (-3,-2) to the point (1, 5), if you can only move up or to the right one unit at a time?
	1. 420 b. 330 c. 702 d. 540 e. NOTA
5. What is the volume of a torus that has an inner radius of 5 and an outer radius of 7?
	1. $36π$ b. $48π^{2}$ c. $15$ d. $12π^{2}$ e. NOTA
6. Find the area of the shaded region, if the largest square
has a side length of 10 and the squares continue infinitely:
	1. $\frac{100}{3}$ b. 50

c. $\frac{75}{6}$ d. $\frac{200}{3}$ e. NOTA

1. What is the volume when the curve $x^{2}-4x+y^{2}-6y-12=0$ is rotated around the line y=3?
	1. $\frac{400π}{3}$ b. $\frac{100}{3}$ c.$ 500π$ d. 125 e. NOTA
2. What is the area of the quadrilateral formed when the fourth roots of 16 are graphed on the Argand (complex) plane?
	1. 16*i* b. 8 c. 4 d. 6*i* e. NOTA
3. Which is a possible final vertex of the parallelogram with vertices at (-1,-2), (2,2), and (1,3)?
	1. (0,0) b. (-1,-1) c. (7,4) d. (3,1) e. NOTA
4. What does the equation $\left|z\right|=3$ look like when graphed on the Argand (complex) plane?
	1. circle b. ellipse c. hyperbola d. line e. NOTA
5. What is the volume of the three-dimensional figure defined by the equation: $\frac{x^{2}}{4}+\frac{y^{2}}{9}+\frac{z^{2}}{50}=2?$
	1. $8π\sqrt{5}$ b. $180π$ c. $160π$ d. $120π\sqrt{2}$ e. NOTA
6. What is the shortest distance from the point (3,2) to the point (5,-4), if you must first go through a point on the line x=1?
	1. 6 b. 72 c. $6\sqrt{2}$ d. $4\sqrt{3}$ e. NOTA
7. What is the area of the polygon formed by the points (2,3), (4,-1), (5,0), (4,1), and (-2,0)?
	1. $\frac{19}{2}$ b. $12$ c. $28$ d. 14 e. NOTA
8. $\left|e^{\frac{πi}{6}}\right|=$
	1. 0 b. $-\frac{\sqrt{3}}{2}$ c. $\frac{π}{3}$ d. $\frac{\sqrt{2}}{2}$ e. NOTA
9. Find the horizontal asymptote(s) of $y=\frac{5}{e^{x}+2}$
	1. y=0 b. $y=\frac{5}{2}$, y=0 c. y=5 d. y= ½ , y=0 e. NOTA
10. What type of conic is defined by the following equation?

$$r=\frac{3}{5-2cosθ}$$

* 1. Ellipse b. Parabola c. cardioid d. hyperbola e. NOTA
1. A flying reindeer is attached by a rope to the upper corner of a cube-shaped house. The house has a side length of 40 feet, and the rope is 18 feet long. How much volume (in cubic yards) of air can the reindeer fly in?
	1. $\frac{28π}{3}$ b. $\frac{224π}{3}$ c. $2,400π$ d. $252π$ e. NOTA
2. What is the area of the annulus formed by the two concentric circles? (AB = 8, and the segment is tangent to the smaller circle)
	1. $25π$ b. $32π$ c. $16π$ d. $4π$ e. NOTA

A

B

1. What is the equation of the line given when y = 3x+9 is reflected about the line y=x?
	1. $y=-3x$ b. $y=\frac{1}{3}x-3$
	2. $y=3x-5$ d. $y=\frac{1}{3}x-9$ e. NOTA
2. Find the length of the latus rectum of this conic: $3y^{2}-4x^{2}-6y-24x-105=0$.
	1. $6$ b. $2\sqrt{3}$ c. $1$ d. $3\sqrt{6}$ e. NOTA
3. What is the shortest distance between the circles $x^{2}+y^{2}+6x-2y-15=0$ and

$x^{2}+y^{2}-10x-8y-40=0$?

* 1. $\sqrt{73}-16$ b. $\sqrt{73}-6$ c. $10$ d. $\frac{\sqrt{73}}{3}-1$ e. NOTA
1. What is the volume when the line $y=x+2$ from x=2 to x=6 is revolved around the x-axis?
	1. $\frac{572π}{3}$ b. $78π$ c. $124π$ d. $\frac{448π}{3}$ e. NOTA
2. Which of the following vectors is perpendicular to <3, -1, 6>?
	1. <2,3,1> b. <1,9,1> c. <1,1,1> d. <1,-3,0> e. NOTA
3. Triangle ABC is circumscribed about the circle. AB = 6. Angle ACB is $105°$. What is the
radius of the circle? (hint: don’t bother rationalizing denominators for any step or your final answer)
	1. $\frac{6}{4+\sqrt{3}}$ b. $\frac{1+\sqrt{3}+\sqrt{2}}{12}$

C

$$45°$$

c. $\frac{3}{2\sqrt{3}+\sqrt{2}+1}$ d. $\frac{6}{4+\sqrt{3}+2\sqrt{2}}$ e. NOTA

B

A

1. If $\cosh(x=\frac{e^{x}+e^{-x}}{2})$, $\sinh(x=\frac{e^{x}-e^{-x}}{2})$, evaluate: $(cosh\frac{π}{2}+sinh\frac{π}{2})(sinh\frac{π}{2}-cosh\frac{π}{2})$
	1. 0 b. 1 c. -1 d. $\frac{1}{\sqrt{2}}$ e. NOTA
2. What is the distance from the point (1,0,2) to the plane 4x-4y+2z=5?
	1. $\frac{4}{3}$ b. $\frac{1}{6}$ c. $4$ d. $\frac{6}{5}$ e. NOTA
3. How many intersection points do the graphs of $r=2cosθ$ and $r=2cos⁡(2θ)$ share?
	1. 1 b. 2 c. 4 d. 6 e. NOTA
4. Express the following parametric curve as a Cartesian function:

$\frac{x}{\sin(t)\cos(t)}=1$ $y=(\sin(t)+\cos(t)(\cos(t)-\sin(t)))$

* 1. $x^{2}+y^{2}=1$ b. $4x^{2}+y^{2}=1$

c. $y-2x^{2}-4=0$ d. $x+y-4=0$

e. NOTA