(1) D $100\text{yd}\left(\frac{3\text{ft}}{1\text{yd}}\right)\left(\frac{1\text{m}}{5280\text{ft}}\right)\left(\frac{1\text{hr}}{70\text{m}}\right)\left(\frac{3600\text{s}}{1\text{hr}}\right)$
$= 2.9228$

2. B $\tan\lambda = 1 \quad \lambda = \frac{\pi}{4}$
$\tan\psi = \frac{\sqrt{3}}{3}, \quad \psi = \frac{7\pi}{6}$
$\frac{\pi}{4} + \frac{7\pi}{6} = \frac{17\pi}{12}$

(3) A Earth's orbit is slightly elliptical, but it's eccentricity is closest to 1.

(4) A x number of an n-gon
$\frac{x^2(n-2)}{2} - \frac{x(n-4)}{2}, \quad x=56, n=3$
1596

(5) 3 work = force · distance
$\langle 3,4,5\rangle \cdot \langle 0-4, 2-2, 3-0\rangle = 3$

(6) D

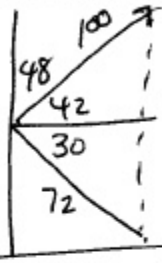
$\sum = 99$

(7) B
I $\frac{1+\sin^2\theta\tan^2\theta-\cos^2\theta}{\sin\theta} = \frac{\sin\theta\sec^2\theta}{\sin\theta}$
$\sec\theta\tan\theta \Leftrightarrow$ B
II $2\sqrt{\cos 2\theta + \cos^2\theta - \sin^4\theta} = 2\sin\theta\cos\theta$
II $\sin 2\theta \Leftrightarrow$ A
III $\frac{\sec\theta}{\tan\theta}\cdot\frac{\cot\theta}{\cos\theta}\cdot\frac{\sin\theta}{\sec\theta} = 1$
III $1 \Leftrightarrow$ C
I B, II A, III C

(8) A $h=0$, solving the quadratic, $t = 7.82$ sec. Plug into $d=rt$ with $r=32$, you get 250 feet or 83 yds.

(9) E $\sum_{n=0}^{2000}\sqrt{\cos\frac{2\pi}{2}} = \sqrt{1} + \boxed{0+i+0+1}\times$
$= 501 + 500i$

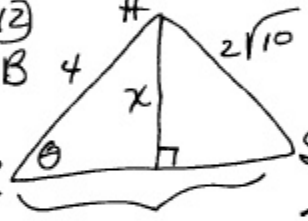
(10) A



$c^2 = 100^2 + 72^2 - 2\cdot100\cdot72\cos$
$c^2 = 10734.155\ldots$
$c = 103.60$

(11) D $2.62\times10^{22}\text{ spheres}\left(\frac{2r}{\text{sphere}}\right)\left(\frac{1.86\times10^{-10}\text{ m}}{r}\right)\left(\frac{1\text{ km}}{1000\text{ m}}\right)$
$9.7464\times10^9\text{ km}\left(\frac{1\text{ mi}}{1.609\text{ km}}\right) = 6.057$
(rounded to 3 sig figs.)

(12) B



$c = 2\sqrt{10}, a=7, b=4$
$c^2 = a^2+b^2-2ab\cos\theta$
$25 = 56\cos\theta$
$\sin\theta = \frac{9\sqrt{31}}{56}, \quad A = \frac{1}{2}\cdot4\cdot7\cdot\frac{9\sqrt{31}}{56} = \frac{9\sqrt{31}}{4}$
$\frac{7}{2}x = \frac{9\sqrt{31}}{4}, \quad x = \frac{9\sqrt{31}}{14}$

(13) E nobody gets it: $\frac{1}{2}\cdot\frac{1}{5}\cdot\frac{1}{4}\cdot\frac{3}{5} = \frac{3}{250}$
Eric gets it, 1st try: $\frac{1}{2}\cdot\frac{1}{5}\cdot\frac{1}{4}\cdot\frac{2}{5} = \frac{1}{100}$
Eric gets it, 2nd try: $\frac{1}{100}\cdot\frac{3}{200}$
3rd try $\left(\frac{3}{200}\right)^2\cdot\frac{1}{100}$
$\sum = \frac{t_1}{1-r}, \quad t_1 = \frac{1}{100}, \quad r = \frac{3}{200} = \frac{2}{197}$

(14) A ${}_8C_2 = 28$

1,2	2,3	3,4	4,5	5,6	6,7	7,8
1,3	2,4	3,5	4,6	5,7	6,8	
1,4	2,5	3,6	4,7	5,8		
1,5	2,6	3,7	4,8			
1,6	2,7	3,8				
1,7	2,8					
1,8						

$p(1) = \frac{7}{28}\ p(2) = \frac{13}{28}\ p(3) = \frac{1}{2}$
$p(4) = \frac{22}{28}\ p(5) = \frac{25}{28}\ p(6) = \frac{27}{28}\ p(7)$
$E(1) = \frac{14}{56}\quad E(2) = \frac{13}{56}\quad E(3) = \frac{12}{56}\ldots$
$n=1$ maximizes $E(n)$

(5) C $x = \frac{9}{5}x + 32$, $x = -40$

(6) D $4 \cdot {}_{10}C_3 \cdot {}_{15}C_3 = 218,400$

(7) $f(x) = \frac{(x-3)x^3}{(x-3)(x-4)}$ 4 | 1 −9 27 −27 / 4 −20 28 / 1 −5 7 | 1

$y = x^2 - 5x + 7$, $x = 4$

(18) A 

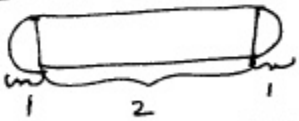
$60000\text{ft}\left(\frac{1\text{mi}}{5280\text{ft}}\right)\left(\frac{1\text{hr}}{500\text{mi}}\right)\left(\frac{3600\text{s}}{1\text{hr}}\right) = 81.8$

(19) B

(20) B $\frac{1}{2} = e^{k \cdot 50}$, $k = \frac{-\ln 2}{50}$
$A = 100 \cdot e^{\frac{-\ln 2}{50} \cdot 125} = 25\sqrt{2}$

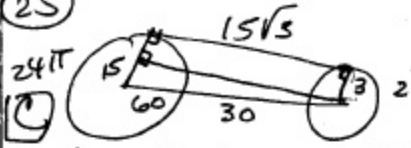
(21) A $\sum_{x=2}^{\infty} \frac{3x^4+1}{x^2(x^2-1)(x^2+1)} = \frac{A}{x^2} + \frac{B}{(x-1)^2} + \frac{C}{(x+1)^2}$
$A = B = C = 1$
$\sum_{x=2}^{\infty} \frac{1}{x^2} = \frac{\pi^2}{6} - 1$, $\sum_{x=2}^{\infty} \frac{1}{(x-1)^2} = \frac{\pi^2}{6}$
$\sum_{x=2}^{\infty} \left(\frac{1}{x+1}\right)^2 = \frac{\pi^2}{6} - 1 - \frac{1}{4}$ $\frac{3\pi^2}{6} - \frac{9}{4}$

(22) E $\frac{5280}{3\pi} = 560.$

(23) E 

$\frac{4\left(\frac{23}{24}\right)^3\pi}{3} + 2\pi\left(\frac{23}{24}\right)^2 = 9.4$

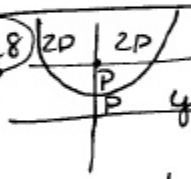
(24) sum of products of lengths of opposites = product of diags.
$BD = 5$ & $AD = 2\sqrt{6}$
$3.2\sqrt{6} + 4.1 = 5x$, $x = \frac{6\sqrt{6}+4}{5} = AC$
$AC = \frac{a+b\sqrt{b}}{c}$, $a = 4$, $b = 6$, $c = 5$
Sum is 15

(25) C 

length of cord $30\sqrt{3} + 26\pi$
$\frac{30\sqrt{3}+26\pi}{6\pi}$ = revolutions of smaller
$2\pi\left(\frac{30\sqrt{3}+26\pi}{6\pi}\right)$ = radians
$\frac{30\sqrt{3}+26\pi}{3} \cdot \frac{1}{30} = 1.484$ ft.

(26) E $L_1: y = x$ $\langle 1,1\rangle$
$L_2: y - 10 = -2(x-10)$; $y = -2x + 30$ $\langle 1,-2\rangle$
$\cos\theta = \frac{\langle 1,1\rangle \cdot \langle 1,-2\rangle}{\sqrt{5}\ \sqrt{2}}$; $\theta = \cos^{-1}\left(-\frac{1}{\sqrt{10}}\right)$
$180 - 108.43 = 71.57$

(27) D $\lim_{h \to 0} \frac{\sin(x+h) - \sin x}{h} = \cos x$

(28) B 

$(0,-1)$ $4A + 2B + C = 0$
$(2,0)$ $4A - 2B + C = 0$
$(-2,0)$ $C = -1$
$A = \frac{1}{4}$, $B = 0$
$y = \frac{1}{4}x^2 + 0x - 1$

(29) B $x^2 - y^2 = 1$
$r^2\cos^2\theta - r^2\sin^2\theta = 1$
$r^2\cos 2\theta = 1$, $r = \pm\sqrt{\sec 2\theta}$

(30) B We could answer A, B, C, D, E or not answer at all. Only one way will give him a perfect score. $\frac{1}{6}$