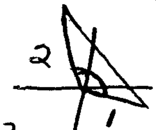
C 1. $(1)^{2003} + 2002 = 2003$

A 2. $\tan\frac{\pi}{4} = 1$

D 3. $\cos^2\theta - \sin^2\theta = \cos(2\theta)$

B 4.  $\theta = \frac{7\pi}{12} + \frac{\pi}{12} = 2\pi/3$

$d^2 = 2^2 + 1^2 - 2(2)(1)\cos 2\pi/3$

$d = \sqrt{4 + 1 - 2(2)(-1/2)}$

$d = \sqrt{7}$

A 5. $9(x^2 - 2x + 1) - 16(y^2 + 4y + 4) = 199 + 9 - 64$

$9(x-1)^2 - 16(y+2)^2 = 144$

$\frac{(x-1)^2}{16} - \frac{(y+2)^2}{9} = 1$ $m = \pm 3/4$ $pt = (1, -2)$

$3x - 4y = 11$ or $3x + 4y = -5$

D 6 $r = \frac{5/2}{1 - \frac{3}{2}\sin\theta}$ accent $= 3/2 > 1$

hyperbola

A 7. $\sum_{n=4}^{\infty} \frac{5}{(n-3)(n+2)}$ $\frac{A}{n-3} + \frac{B}{n+2} = \frac{5}{(n-3)(n+2)}$

$A(n+2) + B(n-3) = 5$

$B = -1$ $A = 1$

$\sum_{n=4}^{\infty} \left[\frac{1}{n-3} - \frac{1}{n+2}\right] = \frac{1}{1} - \frac{1}{6} + \frac{1}{2} - \frac{1}{7} +$

$\frac{1}{3} - \frac{1}{8} + \frac{1}{4} - \frac{1}{9} + \frac{1}{5} - \frac{1}{10} + \ldots$

$1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} = \frac{137}{60}$

D 8. $f(x)$ is odd function except for last term $f(-x) = -f(x)$

$f(a) - 7 = -8 - 7$ $f(a) - 7 = -15$

$f(-a)$ would be $+15$ and then add 7

$f(-a) = 22$

D 9. $\log 216 = a$ $3\log 6 = a$ $\log 6 = \frac{a}{3}$

$\log 625 = b$ $4\log 5 = b$ $\log 5 = b/4$

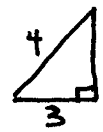
$\log 1/12 = \log 5/60 = \log 5 - \log 6 - \log 10 =$

$\frac{b}{4} - \frac{a}{3} - 1 = \frac{3b - 4a - 12}{12}$

C 10. $f(x) = \frac{4(x-3)(x^2 + 3x + 9)}{(x+3)(x-3)(5x-2)}$

vert asy $x = -3$; $x = 2/5$

$\lim_{x\to\infty} \frac{4(x^2 + 3x + 9)}{(x+3)(5x-2)} = 4/5$ horiz asy $y = 4/5$

E 11. $-8(\cos^2 x - \sin^2 x) = -6$ 

$\cos 2x = +3/4$

$\frac{\pi}{2} < x < \pi$ $\pi < 2x < 2\pi$ Quad III or IV

$\sin 2x < 0$ $-\sqrt{7}/4$

A 12. $\frac{|2(-3) - 3(5) + 2(2) - 4|}{\sqrt{4 + 9 + 4}} = \frac{21}{\sqrt{17}} = \frac{21\sqrt{17}}{17}$

D 13. $x^3 - y^3 = (x-y)(x^2 + xy + y^2) = 1456$

$(x-y)^2 = x^2 - 2xy + y^2 = 14^2 = 196$

$x^2 + y^2 = 196 + 2xy$

$1456 = 28(196 + 2xy + xy)$

$52 = 196 + 3xy$

$-144 = 3xy$

$-48 = xy$

D 14. $\frac{x+3}{8} = \tan t$ $\frac{(x+3)^2}{64} = \tan^2 t$

$\frac{y-2}{4} = \sec t$ $\frac{(y-2)^2}{16} = \sec^2 t$

$1 = \sec^2 t - \tan^2 t$ $1 = \frac{(y-2)^2}{16} - \frac{(x+3)^2}{64}$

$\frac{c}{a} = \frac{\sqrt{16 + 64}}{4} = \frac{\sqrt{80}}{4} = \frac{4\sqrt{5}}{4} = \sqrt{5}$

A. 15 $\frac{3}{4} = \frac{3x+2}{2x-3}$ $6x - 9 = 12x + 8$

$-17 = 6x$

$\frac{-17}{6} = x$

$\frac{-17}{6} = f^{-1}\left(\frac{3}{4}\right)$

A 16. Amplitude $= \sqrt{3^2+4^2} = 5$

Vert shift $= 6$

$5+6=11$ = max value

D. 17. $\dfrac{\sin 50^\circ}{3(2\sin^2 20^\circ - 1)} = \dfrac{\sin 50^\circ}{3(-\cos 40^\circ)}$

$\dfrac{\sin 50^\circ}{-3\cos(90^\circ - 50^\circ)} = \dfrac{\sin 50^\circ}{-3\sin 50} = -\tfrac{1}{3}$

B 18. Prob(four Rec X or five Rec X) =

Prob(four Rec X) + Prob(five rec X) =

${}_5C_1\left(\tfrac{1}{3}\right)^4\left(\tfrac{2}{3}\right) + {}_5C_0\left(\tfrac{1}{3}\right)^5 = 5\left(\tfrac{1}{81}\right)\left(\tfrac{2}{3}\right) + \tfrac{1}{243} =$

$11/243$

A 19. $(-\sqrt{3}+i)^{10} = \left(2\,\mathrm{cis}\,\tfrac{5\pi}{6}\right)^{10} =$

$2^{10}\,\mathrm{cis}\left(10 \cdot \tfrac{5\pi}{6}\right) = 2^{10}\,\mathrm{cis}\,\tfrac{\pi}{3} = 512 + 512\sqrt{3}i$

D. 20. $(e^{3x} - 4e^{2x}) + (-9e^x + 36) = 0$

$e^{2x}(e^x - 4) - 9(e^x - 4) = 0$

$(e^x - 4)(e^x - 3)(e^x + 3) = 0$

$e^x = 4 \quad e^x = 3 \quad e^x = -3$

Solutions $\ln 4, \ln 3$ sum $= \ln 12$

C 21. $(\log_7 125)(\log_5 49) - (\log_6 27)(\log_9 8)$

$\dfrac{3\log 5}{\log 7} \cdot \dfrac{2\log 7}{\log 5} - \dfrac{3\log 3}{4\log 2} \cdot \dfrac{3\log 2}{2\log 3} =$

$3 \cdot 2 - \dfrac{3}{4} \cdot \dfrac{3}{2} = 6 - \dfrac{9}{8} = 39/8$

C 22. $(3x-y)^5 = 243x^5 - 405x^4y$

$+ 270x^3y^2 - 90x^2y^3 + 15xy^4 - y^5$

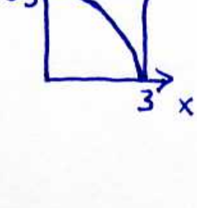
$243 - 405 + 270 - 90 + 15 - 1 = 32$

C 23. Call the two numbers x & y.

We know $0 < x < 3$ and

$0 < y < 3$. We want

$x^2 + y^2 < 9$ which is $\tfrac{1}{4}$ of circle.



Ratio of areas $= \dfrac{(9\pi)\frac{1}{4}}{9} =$

$\pi/4$

B 24. $g(x) = \log_2\left(\sin x \cdot \cos x \cdot \dfrac{\cos(2x)}{\cos(4x)}\right)$

$g(x) = \log_2\left(\tfrac{1}{2}\sin(2x) \cdot \cos(2x)\cos(4x)\right)$

$g(x) = \log_2\left(\tfrac{1}{4}\sin(4x)\cos(4x)\right) = \log_2\left(\tfrac{1}{8}\sin 8x\right)$

$g\left(\tfrac{\pi}{48}\right) = \log_2\left(\tfrac{1}{8}\sin\tfrac{8\pi}{48}\right) = \log_2\left(\tfrac{1}{8}\log \pi/6\right) =$

$\log_2\left(\tfrac{1}{16}\right) = -4$

E 25. Total # of factors $10^3 \cdot 3 =$

$4 \cdot 4 \cdot 2 = 32$ $\quad 5^3 \cdot 2^3 \cdot 3^1$

Even # of factors = total − odd #

Odd: $5^3 \cdot 3^1 \Rightarrow 4 \cdot 2 = 8$

$32 - 8 = 24$

C. 26. $\tan(\alpha - B) = \dfrac{\tan\alpha - \tan B}{1 + \tan\alpha\tan B}$ $\quad \tan\alpha = 7$ $\quad \tan B = 3/4$

$\tan(\alpha - B) = \dfrac{7 - 3/4}{1 + 7(3/4)} = 1 \quad \alpha - B = \boxed{\pi/4}$ or $3\pi/4$

A 27. $\sin\left(\tfrac{15\pi}{18} + \tfrac{5\pi}{9}\right) = \sin\tfrac{15\pi}{9} = \sin\tfrac{5\pi}{3} = -\tfrac{\sqrt{3}}{2}$

B 28. $\dfrac{((\cos x + \sin x) + 1)((\cos x + \sin x) - 1)}{(\cos^4 x - \sin^4 x) + 1} =$

$\dfrac{(\cos x + \sin x)^2 - 1}{(\cos^2 x + \sin^2 x)(\cos^2 x - \sin^2 x) + 1} = \dfrac{(\cos^2 x + \sin^2 x) + 2\sin x\cos x - 1}{\cos^2 x - (1 - \cos^2 x) + 1}$

$\dfrac{2\sin x\cos x}{2\cos^2 x} = \dfrac{\sin x}{\cos x} = \tan x$

B 29. Roots are 3 times larger

$3^0(x^3) + 3^1(8x^2) + 3^2(4x) + 3^3(2) = f(x)$

$x^3 + 24x^2 + 36x + 54 = f(x)$

$(24, 36, 54)$

A 30 $\begin{vmatrix} -2 & 4 & 1 & 1 \\ 3 & 5 & 2 & 1 \\ +1 & -2 & 4 & 1 \\ -4 & 3 & -3 & 1 \end{vmatrix} = \begin{vmatrix} -2 & 4 & 1 & 1 \\ -5 & -1 & -1 & 0 \\ -3 & 6 & -3 & 0 \\ 2 & 1 & 4 & 0 \end{vmatrix} =$

$-1\begin{vmatrix} -5 & -1 & -1 \\ -3 & 6 & -3 \\ 2 & 1 & 4 \end{vmatrix} = 126$