1. Which of the following statements is FALSE?

c (a) The graph of $f(x) = \log(-x)$ is increasing.

(b) The domain of $f(x) = -\log|x-2|$ is $(-\infty, 2) \cup (2, \infty)$.

(c) The x-intercept of the graph of $f(x) = \log_2(2x+1)$ is $(0,0)$.

(d) The range of $f(x) = \log x$ is the set of all real numbers.

(e) The equation of the vertical asymptote of $f(x) = \ln\sqrt{x-1}$ is $x = 1$.

2. The expression $3\log_2 a + 2\log_2 b - \frac{1}{2}\log_2 c$ can be written as

✓ (a) $\log_2\left(\frac{a^3b^2}{\sqrt{c}}\right)$

(b) $\log_2 a^3b^2$

(c) $\log_2\left(\frac{ab^2}{c}\right)$

(d) $\log(a^3bc)$

(e) $\log\left(\frac{a^3b}{\sqrt{c}}\right)$

$= \log_2 a^3 + \log_2 b^2 - \log_2 c^{1/2}$

$= \log_2(a^3b^2) - \log_2\sqrt{c}$

$= \log_2 \frac{a^3b^2}{\sqrt{c}}$

3. The x-intercept and the y-intercept of $f(x) = -2 + \log_4(x+4)$ are

✓(a) x-intercept $(12, 0)$ and y-intercept $(0, -1)$.

(b) x-intercept $(-12, 0)$ and y-intercept $(0, -1)$.

(c) x-intercept $(-12, 0)$ and y-intercept $(0, 1)$.

(d) x-intercept $(-1, 0)$ and y-intercept $(0, 12)$.

(e) x-intercept $(1, 0)$ and y-intercept $(0, -12)$.

x-int.
$0 = -2 + \log_4(x+4)$
$2 = \log_4(x+4)$
$4^2 = x+4$, $x = 12$
$(12, 0)$
y-int.
$y = -2 + \log_4 4$
$y = -2 + 1 = -1$
$(0, -1)$

4. The equation of the adjacent graph is

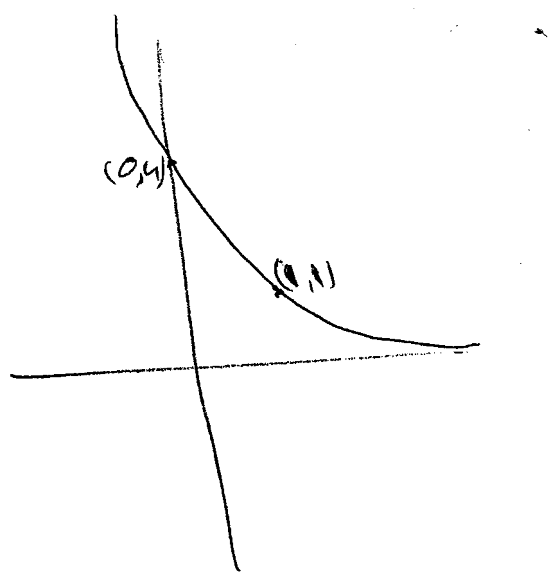
✓(a) $y = 2^{2-2x}$

(b) $y = \left(\frac{1}{4}\right)^{-x} + 1$

(c) $y = -(4^{x+1})$

(d) $y = 4^{x-1}$

(e) $y = \left(\frac{1}{4}\right)^{x}$



Point $(1,1)$ on the graph
$x = 1$, $y = 1$
$x = 0$, $y = 4$ $(0, 4)$

only (a) satisfy the conditions

5. The function $f(x) = -\frac{1}{2}\sin\left(x - \frac{\pi}{2}\right) - 2$ has

(a) Amplitude $= \frac{1}{2}$, period $= 2\pi$ and phase shift $= \frac{\pi}{2}$

(b) Amplitude $= -\frac{1}{2}$, period $= 2\pi$ and phase shift $= \frac{\pi}{2}$

(c) Amplitude $= \frac{1}{2}$, period $= \pi$ and phase shift $= \pi$

(d) Amplitude $= -\frac{1}{2}$, period $= \frac{\pi}{4}$ and phase shift $= \pi$

(e) Amplitude $= \frac{1}{2}$, period $= \pi$ and phase shift $= \frac{\pi}{2}$

amp. $= \left|-\frac{1}{2}\right| = \frac{1}{2}$

period $= \left|\frac{2\pi}{b}\right| = \left|\frac{2\pi}{1}\right| = 2\pi$

p. shift $= -\frac{c}{b} = -\frac{(-\pi/2)}{1} = \frac{\pi}{2}$

6. If $x \in \left[0, \frac{3\pi}{2}\right]$, then the number of the points of intersection between the graph of $y = \sec(2x + \pi)$ and the line $y = 3$ is equal to

period $= \left|\frac{2\pi}{2}\right| = \pi$

phase shift: $-\frac{c}{b} = -\frac{\pi}{2} = -\frac{\pi}{2}$

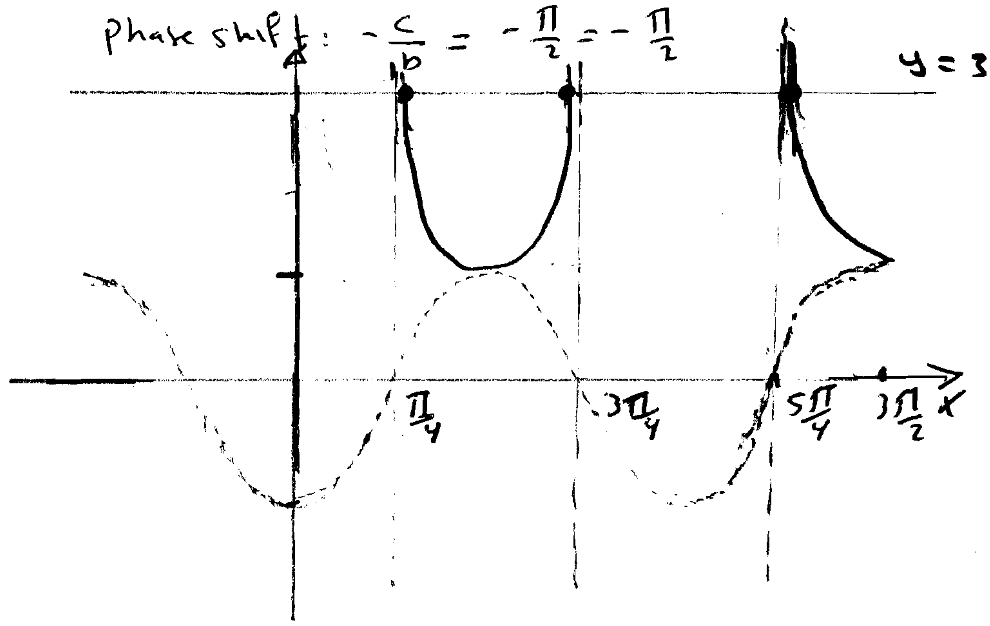
(a) 3

(b) 1

(c) 2

(d) 4

(e) 5



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7. The range of $y = 1 + 4\csc x$ is

(a) $(-\infty, -3] \cup [5, \infty)$

(b) $(-\infty, -3) \cup (5, \infty)$

(c) $(-\infty, -1) \cup (1, \infty)$

(d) $(-\infty, -1] \cup [1, \infty)$

(e) $(-1, 4) \cup (5, \infty)$

$-\infty < \csc x \le -1$ or $1 \le \csc x < \infty$

$-\infty < 4\csc x \le -4$ or $4 \le \csc x < \infty$

$-\infty < 4\csc x + 1 \le -3$ or $5 \le \csc x + 1 < \infty$

R: $(-\infty, -3] \cup [5, \infty)$

8. The number of vertical asymptote(s) of $y = 3\cot\frac{x}{2}$ in the interval $\left(-\frac{\pi}{2}, \pi\right)$ is

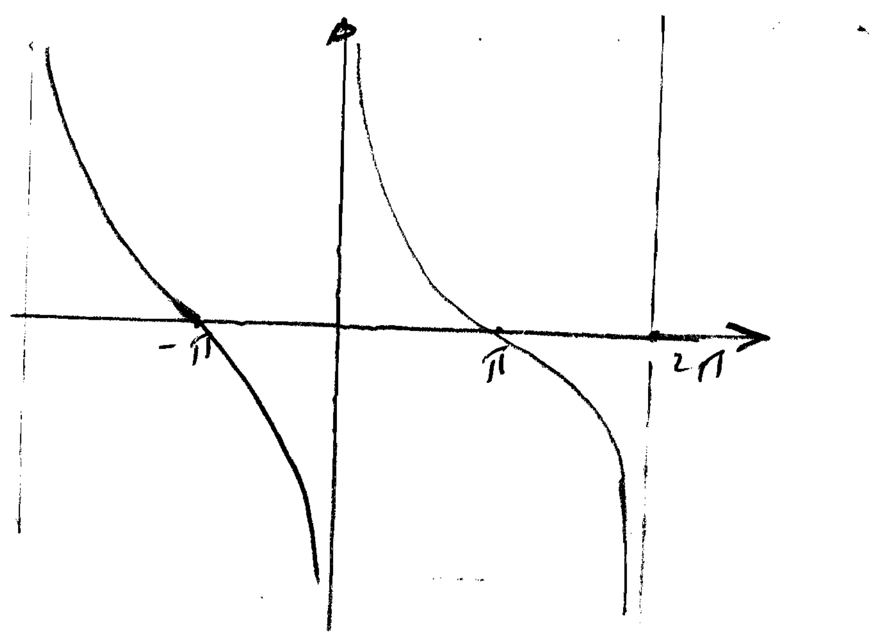
(a) 1

(b) 2

(c) 0

(d) 3

(e) 4



only one asymptote $x = 0$

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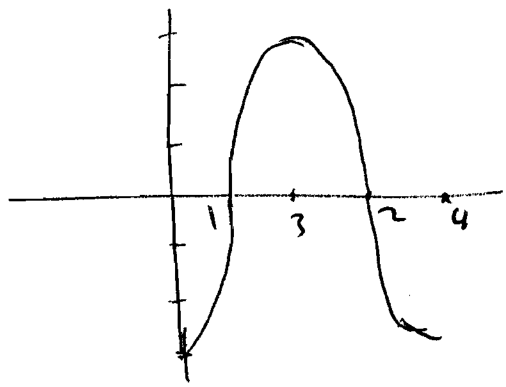
9. The adjacent figure represents the graph of



(a) $y = -3\cos\left(\frac{\pi}{2}x\right)$

(b) $y = 3\sin \pi x$

(c) $y = 3\cos\left(\frac{5\pi}{2}x\right)$

(d) $y = 3\sin(-\pi x)$

(e) $y = -3\cos\left(\frac{3\pi}{2}x\right)$

$y = a\cos bx \qquad a = -3$

$\text{period} = 4 = \frac{2\pi}{b}, \qquad b = \frac{\pi}{2}$

$y = -3\cos\left(\frac{\pi}{2}x\right)$

10. The expression $\dfrac{\sin x}{1+\cos x} + \dfrac{1+\cos x}{\sin x}$ can be simplified to

(a) $2\csc x$

(b) $2\cos x$

(c) $\tan x$

(d) $\sin x - \cos x$

(e) $\sin x + \cos x$

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

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

$$= \frac{1+1+2\cos x}{\sin x(1+\cos x)} = \frac{2(1+\cos x)}{\sin x(1+\cos x)}$$

$$= \frac{2}{\sin x} = 2\csc x$$

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11. If w is the wrapping function, then $w\left(\frac{22\pi}{3}\right)$ is equal to

✓(a) $\left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$

(b) $\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$

(c) $\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

(d) $\left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$

(e) $\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$

$w\left(\frac{22}{3}\pi\right) = w\left(6\pi + \frac{4\pi}{3}\right)$

$= w\left(\frac{4\pi}{3}\right) = (x, y)$

$= \left(\cos\frac{4\pi}{3}, \sin\frac{4\pi}{3}\right)$

$\cos\frac{4\pi}{3} = -\cos\frac{\pi}{3} = -\frac{1}{2}$

$\sin\frac{4\pi}{3} = -\sin\frac{\pi}{3} = -\frac{\sqrt{3}}{2}$

$w\left(\frac{22}{3}\pi\right) = \left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$

12. The reference angle of $\theta = 30$ radians is equal to

✓(a) $10\pi - 30$

(b) $30 - 10\pi$

(c) $30 - 8\pi$

(d) -30

(e) $30 - 6\pi$

$30 = 4(2\pi) + 4.88$

30 in IV

$10\pi \approx 31.4$

$\theta' = 2\pi - (30 - 8\pi)$

$= 10\pi - 30$

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13. If the point $(-2,-3)$ is on the terminal side of the angle θ in the standard position, then $3\sin\theta + 2\cos\theta$ is equal to

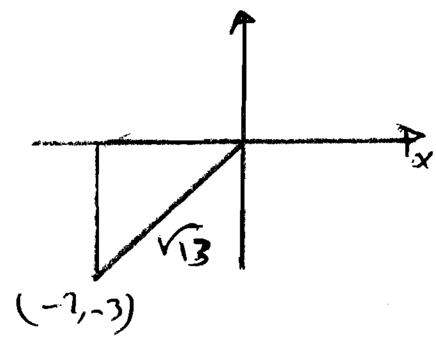
✓(a) $-\sqrt{13}$

(b) $-5\frac{\sqrt{13}}{13}$

(c) $-2\frac{\sqrt{13}}{13}$

(d) $-6\frac{\sqrt{13}}{13}$

(e) 13



$\sin\theta = \frac{-3}{\sqrt{13}}$, $3\sin\theta = \frac{-9}{\sqrt{13}}$

$\cos\theta = \frac{-2}{\sqrt{13}}$, $2\cos\theta = \frac{-4}{\sqrt{13}}$

$3\sin\theta + 2\cos\theta = -\frac{9}{\sqrt{13}} - \frac{4}{\sqrt{13}} = -\frac{13}{\sqrt{13}}$

$= -\sqrt{13}$

14. $\csc(-510°) + 4\cos(150°)\sin(120°) + \tan(405°)$ is equal to

✓(a) -4

(b) 3

(c) 5

(d) -5

(e) -2

$\csc(-510°) = -\csc(510°) = -\csc 210°$
$= -\csc 30°$
$= -2$

$4\cos(150°)\sin(120°) = 4(-\cos 30°)\sin 60°$
$= -4 \frac{\sqrt{3}}{2}\cdot\frac{\sqrt{3}}{2} = -3$

$\tan(405°) = \tan 45° = 1$

$\csc(-510°) + 4\cos 150° \sin 120° + \tan 405°$

$= -2 - 3 + 1 = -4$

17. If α is the smallest positive angle coterminal with $-743°$ and β is the smallest positive angle coterminal with $610°$, then $\alpha - \beta$ is equal to

(a) $87°$ ✓

(b) $105°$

(c) $337°$

(d) $250°$

(e) $225°$

$-743° = x° - 2(360°)$

$x° = -743° + 720 = -23$ (Neg cot)

$\alpha = -23° + 360° = 337°$ (pos. cot)

$610° = x° + 1(360°)$

$x° = 610° - 360° = 250°$

$\beta = 250°$

$\alpha - \beta = 337° - 250°$

$= 87°$

18. The solution of the equation $\dfrac{e^x + e^{-x}}{e^x - e^{-x}} = 3$ is equal to

(a) $\dfrac{\ln 2}{2}$ ✓

(b) $\ln 3$

(c) $\dfrac{\ln 3}{2}$

(d) $\ln\left(\dfrac{2}{3}\right)$

(e) $\dfrac{\ln 2}{3}$

$e^x + e^{-x} = 3e^x - 3e^{-x}$

$e^{2x} + e^0 = 3e^{2x} - 3e^0$

$e^{2x} - 3e^{2x} = -4$

$2e^{2x} = 4$

$e^{2x} = 2$

$2x \ln e = \ln 2$

$2x = \ln 2$

$x = \dfrac{\ln 2}{2}$

19. The solution of the equation $\log(x+8)+\log(2x+13) = \log(4-x)$ consists of

✓ (a) One negative integer only.

(b) One positive real number only.

(c) Two non-negative integers.

(d) Two positive real numbers.

(e) One negative and one positive integers.

$\log(x+8)(2x+13) = \log 4-x$

$\log(2x^2+29x+104) = \log(4-x)$

$2x^2+29x+104 = 4-x$

$2x^2+30x+100=0$

$x^2+15x+50=0$

$(x+5)(x+10)=0$

$x=-10$

$x=-5$

reject $x=-10$, solution $\boxed{x=-5}$

20. If $\log_2 5 = x$ and $\log_2 3 = y$, then $\log_{\sqrt{2}} 30$ is equal to

✓ (a) $2(x+y+1)$

(b) $\frac{1}{2}(x+y+1)$

(c) $\frac{x+y}{2}$

(d) $2x+1$

(e) $\frac{x+2y}{2}$

$\log_{\sqrt{2}} 30 = \frac{\log_2 30}{\log_2 \sqrt{2}} = 2\log_2 30$

$2\log_2 30 = 2\log_2(5\cdot 6)$

$= 2[\log_2 5 + \log_2 6]$

$= 2[\log_2 5 + \log_2 2\cdot 3]$

$= 2[\log_2 5 + \log_2 2 + \log_2 3]$

$= 2(x+1+y)$

21. If $f(x) = a^x$ and $f(-2) = \frac{1}{3}$, then $f(6)$ is equal to

(a) 27

(b) 2

(c) 9

(d) 12

(e) 18

$f(-2) = a^{-2} = \frac{1}{a^2} = \frac{1}{3}$

$f(6) = a^{-6} = \frac{1}{a^6} = \left(\frac{1}{a^2}\right)^3 = \left(\frac{1}{3}\right)^3$

$= \frac{1}{27}$

22. Which of the following is undefined

(a) $\ln(\cos \pi)$

(b) $\cos(\ln 1)$

(c) $\sin(\ln 1)$

(d) $\log(\ln e)$

(e) $\log(\cos 0)$

$\cos \pi = -1$

$\ln(-1)$ undefined.