The following were changed at the resolution center at the convention: #7 thrown out, #11 33

1. $\boxed{\frac{-1}{9}}$ Part A: As $x \to 1$, we can assume that $x > 0$, so $\lim_{x\to 1}\frac{|x|-x}{x-1} = 0$. Part B: $\lim_{x\to 0}\frac{\cos x - 1}{x} = \lim_{x\to 0}\frac{(\cos x - 1)(\cos x + 1)}{x(\cos x + 1)} = \lim_{x\to 0}\frac{-\sin x\cdot\sin x}{x(1+\cos x)} = \lim_{x\to 0}\left(-\sin x\cdot\frac{\sin x}{x}\cdot\frac{1}{\cos x + 1}\right) = 0\cdot 1\cdot\frac{1}{2} = 0$. Part C: $\lim_{x\to 3}\frac{(1/x)-(1/3)}{x-3} = \lim_{x\to 3}\left(\frac{3-x}{3x}\cdot\frac{1}{x-3}\right) = \lim_{x\to 3}\frac{-1}{3x} = \frac{-1}{9}$. Sum the parts.

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2. $\boxed{4.1}$ Part A: $(f\cdot g)'(3) = f\cdot g' + g\cdot f' = (5)(.7)+(-4)(1.1) = -0.9$

Part B: $\left(g/f\right)'(-2) = \frac{f\cdot g' - g\cdot f'}{f^2} = \frac{(1)(5)-0}{1^2} = 5$. Sum the parts.

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3. $\boxed{-1\frac{23}{24} \text{ or } \frac{-47}{24}}$ Part A: $f'(x) = 3x^2 - 2x - 1 = 0 @ x = 1$ and $\frac{-1}{3}$. Finding the y-values for these and also for the endpoints shows that $x = -2$ yields the minimum y-value. Part B: This problem requires the relative extrema of the third derivative, so we have to find the 4th derivative $\Rightarrow y^{(iv)} = 24x - 1 = 0 @ x = \frac{1}{24}$. There are no values where the derivative does not exist. Sum the parts.

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4. $\boxed{\frac{5\pi^2}{2}}$ Part A: (Disk) $V = \int_0^{\pi}\pi\sin^2 x\,dx = \frac{\pi^2}{2}$. Part B: (Shell) $V = \int_0^{\pi} 2\pi x\sin x\,dx = 2\pi^2$. Sum the parts.

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5. DCAB

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6. $\boxed{\frac{1}{3}}$ Part A: Not moving means $v = 0 \Rightarrow v = 6t - 2 = 0 @ x = \frac{1}{3}$. Part B: Changing direction means v changes sign $\Rightarrow v = 3(2t-3)^2(2)$ and is positive for all values of t. So, the particle never changes direction, or zero times. Sum the parts.

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7. $\boxed{4}$ Part A diverges by the n^{th} term test, so subtract 5. Part B converges by the integral test, so add 3. Part C converges by the comparison test with a geometric series, so add 3. Part D converges by the Ratio Test, so add 3. Sum the parts.

The following were changed at the resolution center at the convention: #7 thrown out, #11 33

8. $\boxed{\frac{8+75\sqrt{5}}{50}}$ Part A: $\tan\theta = \frac{h}{40} \Rightarrow \frac{d\theta}{dt} = \frac{1}{40}\cos^2\theta \frac{dh}{dt}\Big|_{h=30} = \frac{1}{40}\left(\frac{4}{5}\right)^2 (10) = \frac{4}{25}$. Part B:

We need to find $\frac{ds}{dt}$ when $x=1, y=2$ and $\frac{dx}{dt} = \frac{3}{2}$.

So, $s^2 = x^2 + y^2 = x^2 + (x^2+1)^2 \Rightarrow \frac{ds}{dt} = \frac{3x+2x^3}{s} \cdot \frac{dx}{dt}\Big|_{x=1} = \frac{3\sqrt{5}}{2}$. Sum the parts.

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9. $\boxed{1}$ Part A: Change (so we can use L"Hopital's) to $\lim\limits_{x\to\infty} \frac{\sqrt{x}}{e^x} = \lim\limits_{x\to\infty} \frac{(1/2\sqrt{x})}{e^x} = \lim\limits_{x\to\infty} \frac{1}{2e^x\sqrt{x}} = 0$.

Part B: Let

$y = \lim\limits_{x\to\infty}(x-1)^{\frac{1}{x}} \Rightarrow \ln y = \lim\limits_{x\to\infty}\left[\frac{1}{x}\ln(x-1)\right] = \lim\limits_{x\to\infty}\frac{(1/x-1)}{1}$ (by L"Hopital's). Therefore,

$\ln y = \lim\limits_{x\to\infty}\frac{1}{x-1} = 0$ and $y = e^0 = 1$. Sum the parts.

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10. $\boxed{\frac{1}{24}}$ Part A:

$f(x) = \frac{e^x - e^{\frac{x}{2}}}{2} \Rightarrow f'(x) = \frac{1}{4}\left(2e^x - e^{\frac{x}{2}}\right) \Rightarrow f''(x) = \frac{1}{8}\left(4e^x - e^{\frac{x}{2}}\right)\Big|_{x=0} = \frac{3}{8}$. Part B:

$\frac{dx}{dt} = 3t^2$ & $\frac{dy}{dt} = 2t \Rightarrow \frac{dy}{dx} = \frac{2}{3t} \Rightarrow \frac{d^2y}{dx^2} = \frac{(3t)\cdot 0 - 2\cdot\left(3\cdot\frac{dt}{dx}\right)}{6t^2} = \frac{(-6/3t^2)}{6t^2} = \frac{-1}{3t^4}\Big|_{t=1} = \frac{-1}{3}$.

Sum the parts.

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11. $\boxed{31}$ Part A: The rectangle areas sum to $[2\cdot f(1) + 2\cdot f(2) + 2\cdot f(3)] = 2+4+20 = 26$.

Part B: Only 2 rectangles can be inscribed, the others have a height of zero. So the sum of the areas of those 2 rectangles is $[1\cdot f(1) + 1\cdot f(2)] = 4+1 = 5$. Sum the parts.

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12. $\boxed{5}$ Part A: Set $x'(t) = -4\cos t = 0 \Rightarrow t = \frac{\pi}{2}, \frac{3\pi}{2} \Rightarrow x = -1, 7$. Part B: Use implicit

differentiation to get $\frac{dy}{dx} = \frac{2x+1}{2y}$. The tangent is vertical when $y = 0$, hence $x = -2, 1$.

Sum the parts.

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13. $\boxed{\text{III only}}$ Statements I and II are both always true by the Extreme Value Theorem. Statement III is false. Consider $y = x^2$ on $[1,4]$. Then $f'(c) \neq 0$ for $1 < c < 4$.

The following were changed at the resolution center at the convention: #7 thrown out, #11 33

14. 10 Part A: The 3rd derivative at $x = 3$ is found in the 4th term. It is the coefficient of $\frac{(x-3)^3}{3!}$.

So, $f'''(3) = 7$. Part B: the 4th derivative is part of the coefficient of the 4th degree term.

$\frac{f^{(4)}(0)}{4!}x^4 = \frac{x^4}{(2)(4)} \Rightarrow f^{(4)}(0) = \frac{4!}{8} = 3$. Sum the parts.

The following were changed at the resolution center at the convention: #7 thrown out, #11 33

	Mu Bowl Answers
1.	$-\frac{1}{9}$
2.	4.1
3.	$-\frac{47}{24}$ or $-1\frac{23}{24}$
4.	$\frac{5\pi^2}{2}$
5.	DCAB
6.	$\frac{1}{3}$
7.	4
8.	$\frac{8+75\sqrt{5}}{50}$
9.	1
10.	$\frac{1}{24}$
11.	31
12.	5
13.	III only
14.	10