1. A = $\cos(\ln(e^0+0+0^2))\dfrac{e^0+1+2\cdot 0}{e^0+0+0^2}=2$. B = $\int_0^{\pi}\dfrac{1+\cos 2x}{2}dx=\dfrac{\pi}{2}+0=\dfrac{\pi}{2}$. C = 0 since the function is odd. D = $g'(0)=\dfrac{1}{(1-0)^2}=1$. A+B+C+D = $\boxed{3+\dfrac{\pi}{2}}$

2. A = $\lim\limits_{x\to 2}\dfrac{x+2}{x+4}=\dfrac{2}{3}$. B = $\lim\limits_{x\to 0}\dfrac{7}{2}\dfrac{\sin(7x)}{7x}=\dfrac{7}{2}\cdot 1$. C = $\lim\limits_{x\to\infty}\dfrac{\sqrt{x^2+4x+4}}{3x+5}=\lim\limits_{x\to\infty}\dfrac{x+2}{3x+5}=\dfrac{1}{3}$. D = 0, since exponentials grow faster than polynomials. A+B+C+D = $\boxed{\dfrac{9}{2}}$.

3. The length the particle has traveled along the curve at time t is given by the arc length formula: $l(t)=\int_0^{2t}\sqrt{1+\cos^2(x)}dx$. The particle's speed at time t is $\dfrac{dl(t)}{dt}=2\sqrt{1+\cos^2(2t)}$, and plugging in $t=\dfrac{\pi}{2}$, our answer is $\boxed{2\sqrt{2}}$.

4. A = $\int_1^2\dfrac{1}{x^2}dx=\dfrac{1}{2}$. B = $\int_0^1\dfrac{2\ln(x+1)}{x+1}dx=2\left[\dfrac{1}{2}\left(\ln(x+1)\right)^2\right]_0^1=\left(\ln 2\right)^2$. C – Use implicit differentiation to solve for $y'=\dfrac{y}{2y-x}$ …now plug in (1,-4) to get 4/9. D = 1, since $y'=\dfrac{-2x}{(x^2+1)^2}e^{\frac{1}{x^2+1}}$ is only zero at x = 0. A+ $e^{\sqrt{B}}$ +C+D = $\boxed{71/18}$

5. A = $\int_0^1 x^3-3x^2+2x+1\,dx=\dfrac{1}{4}-1+1+1=\dfrac{5}{4}$. B = C = 1 since $f'(x)=3x^2-6x+2$ has two real roots (only true for a cubic). D = 1 since $f''(x)=6x-6$ has one real root.
A+B+C+D = $\boxed{17/4}$

6. A= $\int_0^{\pi/4}\cos x-\sin x\,dx+\int_{\pi/4}^{5\pi/4}\sin x-\cos x\,dx+\int_{5\pi/4}^{2\pi}\cos x-\sin x\,dx$
$=\left(\sqrt{2}-1\right)+\left(2\sqrt{2}\right)+\left(1+\sqrt{2}\right)=4\sqrt{2}$.
B = $2\int_0^{\pi}\sin x dx=4$ C = $2\int_{\pi/2}^{3\pi/2}-\cos x dx=4$ B+C – A = $\boxed{8-4\sqrt{2}}$

7. A = $\pi\int_0^1 x^2-x^4dx=\dfrac{2\pi}{15}$ B = $2\pi\int_0^1 x(x-x^2)dx=\dfrac{\pi}{6}$ A / B = $\boxed{4/5}$

8. A = B = 0 by simple algebra (no need to plug in values). C = 1 since the Mean Value Theorem guarantees a point in the interval where $h'(x)=0$ since $h(1)=h(2008)=0$, and this setting the derivative of h equals to zero yields the desired statement. A+B+C = $\boxed{1}$

9. A – We must have $c\sin\dfrac{\pi}{2}+1=4\dfrac{\pi}{2}+2\rightarrow c=2\pi+1$ B = 2 C = $f'(3)=e^3$ where $f(x)=e^x$. A + B + ln C = $\boxed{2\pi+6}$

10. A = $lcm\left\{\dfrac{2\pi}{1/24},\dfrac{2\pi}{1/12}\right\}=lcm\{48\pi,24\pi\}=48\pi$. B = 500000 Integrating d(t) over one period will make the contributions from sin and cos both zero, so the average value is

just $\frac{1}{48\pi}\int_0^{48\pi} 500000dx = 500000$. C = 0 Since the distance will not have changed, the average rate of change will be zero. A+B+C = $\boxed{500000+48\pi}$

11. If the distance from the base to the wall is *x* and the distance from the floor to the top of the ladder is *y*, then $x^2 + y^2 = 20^2$, so implicit differentiation with respect to *t* yields $2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$. Solving for $\frac{dy}{dt}$ and plugging in $x = 10$, $\frac{dx}{dt} = 1$, $y = \sqrt{20^2 - 10^2}$, we get $\left|\frac{dy}{dt}\right| = \left|\frac{-10 \cdot 1}{\sqrt{300}}\right| = \boxed{\frac{\sqrt{3}}{3}}$.

12. $f'(x) = 6x^2 - 10x - 4 = 2(3x+1)(x-2)$ → We must check $x = -10,\ -1/3,\ 0,\ 2,\ 10$

$$f(-4) = -189 \quad f(-1/3) = 3\frac{19}{27} \quad f(0) = 3 \quad f(2) = -9 \quad f(4) = 35$$

A = $\frac{100}{27}$ B = -9 C = $\frac{5}{6}$ by setting $0 = f''(x) = 12x - 10$. ABC = $\boxed{-\frac{250}{9}}$.

13. $\ln h(x) = g(x)\ln f(x) \to \frac{h'(x)}{h(x)} = \frac{g(x)f'(x)}{f(x)} + g'(x)\ln f(x)$, so $h'(x) = f(x)^{g(x)}\left[\frac{g(x)f'(x)}{f(x)} + g'(x)\ln f(x)\right]$. Plugging in x = 1 and using the values in the question, we have $h'(1) = 2^1\left[\frac{1\cdot 3}{2} + 4\cdot\ln 2\right] = \boxed{3+8\ln 2}$.

14. $\int_0^{24}\sqrt{1+[f'(x)]^2}\,dx = \int_0^{24}\sqrt{1+x}\,dx = \int_1^{25}\sqrt{u}\,du = \frac{2}{3}\left(25^{3/2} - 1^{3/2}\right) = \frac{2}{3}(124) = \boxed{\frac{248}{3}}$

15. A – $f'(x) = -2xe^{-x^2} \to f''(x) = -2e^{-x^2} + 4x^2e^{-x^2} = e^{-x^2}(4x^2 - 2)$, so f' attains its maximum at $x = -\frac{\sqrt{2}}{2}$, where its value is $\sqrt{2}e^{-1/2}$. B = 1 since the Mean Value Theorem guarantees for some *c* that $\left|\frac{f(x)-f(y)}{x-y}\right| = f'(c) \le \frac{\sqrt{2}}{\sqrt{e}} < 1$. C = 1 It's pretty easy to see that the graph of *f* will intersect *y* = *x* at one spot. D = 0 By above there is some $c < 1$ where $|x_{n+1} - x_n| = |f(x_n) - f(x_{n-1})| \le c|x_n - x_{n-1}|$, so by repeated application, $|x_{n+1} - x_n| \le c^{n-1}|x_2 - x_1|$ yielding $\lim_{n\to\infty}|x_{n+1} - x_n| = 0$ since $c^{n-1} \to 0$. But this says the difference between $f(x_n)$ and x_n approaches zero, so they must have the same limit *x*. Then $x = \lim_{n\to\infty} x_n = \lim_{n\to\infty} f(x_n) = f(\lim_{n\to\infty} x_n) = f(x)$, so *x* is a fixed point of *f*. It is pretty easy to guess the fixed point of *f* by checking small numbers, and we find that $f(0) = 0$.

$A^2 + B + C + D = \boxed{\frac{2}{e} + 2}$.