35. $$\begin{aligned} f(1)-f(0) &= \int_0^1 \frac{\tan^2 x}{x^2+1}\,dx \\ \frac{1}{2}-f(0) &\approx 0.3446 \\ -f(0) &\approx 0.3446-0.500 \\ f(0) &\approx 0.1554 \end{aligned}$$

There is no easy way to find the antiderivative for the given expression. Evaluate the definite integral on your calculator and use the Fundamental Theorem of Calculus.

The correct choice is (A).

36. Points of inflection are identified via the second derivative of the function.

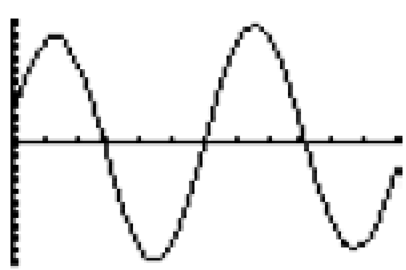
For the function $f(x)=0.25x^2-e^{-x}-\cos(x)-x$,
$f'(x)=0.5x+e^{-x}+\sin(x)-1$,
and $f''(x)=0.5-e^{-x}+\cos(x)$

Graph the second derivative in the window $[0,20]$ by $[-1,1]$. The function $f(x)$ will have a point of inflection each time the second derivative changes sign. This occurs six times in the given interval.

The correct choice is (B).

37. The function increases most rapidly when it has the largest positive slope or when its derivative is largest. $f'(x)=\frac{5.8\pi}{4}\cos\left(\frac{\pi x}{4}\right)+\frac{15.7\pi}{3}\sin\left(\frac{\pi x}{3}\right)$. Graph the derivative in a suitable window such as $x[0,12]$ by $y[-21,21]$. (See figure).

The maximum is the highest point on this graph, which is near $x=7.566$.



The correct choice is (C).

38. The integration of the rate of change, $R(t)$, over the time period of changes, $0 \le t \le 6$, yields the total amount of change for that time period. $\int_0^6 R(t)\,dt \approx 5726$. This total added to the original total of 725 people who had the viral infection at time $t = 0$ days gives a total projected number of 6,451 people who will have the viral infection at $t = 6$ days.

The correct choice is (C).

39. The given limit indicates a horizontal asymptote on the left side of the graph at $y = -3$. Since the function is odd, it is symmetric to the origin and there must be a horizontal asymptote on the right at $y = +3$ and therefore I and III are true. Since the vertical asymptote would indicate a discontinuity and the function is given as continuous there can be no vertical asymptote, II is also true. An example of such a function is $f(x) = \frac{6}{\pi}\tan^{-1}(x)$.

The correct choice is (D).

40. If $f^{-1}(x) = g(x)$, then $g'(x) = \frac{1}{f'(g(x))}$ and $g'(0) = \frac{1}{f'(g(0))}$.

Solve on a graphing calculator $x^3 - 7x^2 + 25x - 39 = 0$. Thus $x = 3$.

Since $f(3) = 0$, $g(0) = 3$.

$f'(x) = 3x^2 - 14x + 25$, $f'(3) = 3(3^2) - 14(3) + 25 = 10$

$g'(0) = \frac{1}{f'(3)} = \frac{1}{10}$

The correct choice is (C).

41. Let $u = x + 2 \Rightarrow du = dx$

$\int_k^6 \frac{dx}{x+2} = \int \frac{du}{u} = \ln|u| = \ln|x+2|\Big|_k^6 = \ln 8 - \ln(k+2) = \ln\left(\frac{8}{k+2}\right)$.

Since $\int_k^6 \frac{dx}{x+2} = \ln k$, $\ln\left(\frac{8}{k+2}\right) = \ln k$, or $\frac{8}{k+2} = k$.

Solving for k, $k^2 + 2k = 8 \Rightarrow k = 2, -4$. Since $k > 0$, the required value of k is 2.

The correct choice is (A).