**ANSWERS:**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>6.</td>
<td>1/32</td>
<td>11.</td>
</tr>
<tr>
<td>2</td>
<td>1/2</td>
<td>7.</td>
<td>-√2/4</td>
<td>12.</td>
</tr>
<tr>
<td>3</td>
<td>-1</td>
<td>8.</td>
<td>48</td>
<td>13.</td>
</tr>
<tr>
<td>4</td>
<td>-5</td>
<td>9.</td>
<td>-1</td>
<td>14.</td>
</tr>
<tr>
<td>5</td>
<td>-1</td>
<td>10.</td>
<td>4</td>
<td>15.</td>
</tr>
<tr>
<td>16.</td>
<td>1/k</td>
<td>17.</td>
<td>-1/3</td>
<td>22.</td>
</tr>
<tr>
<td>21.</td>
<td>11/6</td>
<td>22.</td>
<td>3/8</td>
<td></td>
</tr>
</tbody>
</table>

*one value only.*
SOLUTIONS:
1. \( f'' = 12x - 3 > 0 \) for \( x > 0.25 \), and the least integer is 1.

2. \( \int_0^{\pi/4} \sec^2 x \tan x \, dx = \int u \, du \) for \( u = \tan x \). \( \frac{1}{2} \tan^2 x \left|_0^{\pi/4} \right. = \frac{1}{2}(1 - 0) = 1/2. \)

3. \( f = \sqrt{(x-1)^2} = |x-1| \), and the slope to the left of the cusp is -1.

4. The derivative of \( y = 2x^2 + 3x \) is \( 4x + 3 \). At \( x = -2 \), the derivative is -5.

5. \( 2xe^{2x} + x^2(2e^{2x}) < 0, \) \( 2xe^{2x}(1 + x) < 0 \). Between \( x = 0 \) and \( x = -1 \) this is true, and so \( a = -1 \).

6. \( \frac{dy}{dt} = 8x \frac{dx}{dt}, \quad \frac{dy}{dt} = 8x \left(4 \frac{dy}{dt}\right) \). This is true for \( x = 1/32 \).

7. \( f' = \frac{1}{2} \left(9 - x^2\right)^{-1/2}(-2x) \) and at \( x = 2 \sqrt{2} \), \( f' = -2\sqrt{2} \). so \( g'(1) = 1/ \left( f'(2\sqrt{2}) = -\frac{\sqrt{2}}{4} \right. \).

8. \( f' = 4(g(x))g'(x) \) by the chain rule, and \( 4(4)(3) = 48 \).

9. \( f'' = 6x + 3 < 0 \) and \( f' < 0 \) for the interval \((-2, -1/2)\) and the integer in this interval is -1.

10. \( \frac{1}{6} \left(-\frac{3}{4}x^2 + kx\right) \bigg|_{0}^{6} = -\frac{1}{2} \) when \((-27+6k) = -3\) and \( k = 4 \).

11. The values must be equal at \( x = 1 \) so \( a + 3 + b = 2a - b \) and \(-a + 2b = -3 \). The derivatives must be equal \( 2a + 3 = 2a - b \) so \( b = -3 \), and thus \( a = -3 \). So the abs value of \( a + b \) is 6.

12. \( e^x = e \) when \( x = 1 \), so the area is \( \int_0^1 (e - e^x) \, dx = e - e^0 \bigg|_0^1 = (e - e) - (0 - 1) = 1 \).

13. \( y \frac{dy}{dx} = dx \), \( \frac{y^2}{2} = x + c \), \( 2 = -1 + c, c = 3 \). For the initial condition, we have the function is the "positive" part of the graph \( y = \sqrt{2x + 6} \). When \( x = 5 \) \( y = 4 \).

14. The values of \( f' \) are 0 or undefined at \( x = 0, \pi, \pi/2, 3\pi/2, 2\pi \). Five values.

15. \( 8x + 3 = 9 - 16x \) at \( x = 1/4 \).

16. \( f' \) is zero and \( f'' \) must be positive. \( f' = 0 \) at \( x = 1/k \) or \( x = -2k \). \( f'' = kx^2 + 2k^2x - x - 2k \). When \( x = 1/k \), \( f'' = 2 + 2k^2 - 1 \) which is positive. At \( x = -2k \), \( f'' = -2k^2 - 1 \) which is negative so the x-coordinate of the rel. min is \( 1/k \).

17. \( f(-1) = -2 \) and \( f(1) = 0 \), which gives slope 1. \( f' = 3x^2 - 2x = 1 \) when \( x = -1/3 \) or \( x = 1 \), but the MVT says that the value of \( x = 1 \) is not part of the conclusion, so \( x = -1/3 \).

18. \( 3(6) + \int_0^2 4 \, dx = 18 + 8 = 26 \).

19. For \( f(x) = 3kx + 1, f(1) + f(2) + f(3) + f(4) = 3k + 1 + (6k + 1) + (9k + 1) + (12k + 1) = 30k + 4 = 154 \) gives \( k = 5 \).

20. \( u = x^2 + 1, du = 2x \, dx, \int_1^4 u^{1/2} \cdot (.5 \, du) = \left[\frac{1}{2}u^{3/2}\right]_1^4 = \frac{1}{3}(8 - 1) = 7/3 \).

21. \( f(2) = 1 \) and tangent line has slope \( 6x - 6 = 6 \). \( y - 1 = 6(x - 2) \) has x-intercept \( 11/6 \).
22. \( m = \frac{2(4)}{3} = \frac{8}{3} \). Normal slope = \(-\frac{3}{8}\).

23. The area described by the integral is two triangles like the shaded one shown. So the integral gives area \(2(1/2)(4)(4) = 16\).

24. \( f''=1 \) means \( f' = x+c \) and \( f = \frac{1}{2}x^2 + cx + k \)

and when \( x=1 \) we get \(0.5+c+k=4\).

When \( x=-1 \), we get \(0.5 - c+k= 5\). Add to get \(1+2k = 9\) and so \(k=4\). So \( f(0) = k = 4\).

25. Every fourth derivative is \( \cos x \) so the 40th derivative is \( \cos x \). \( f^{(41)}(x) = -\sin x = -\sin \frac{\pi}{6} = -\frac{1}{2} \).