1. Find $f$ if $f''(x) = 3x - \cos 2x$, $f'(0) = 4$ and $f(0) = -7$.

2. Let $f(x) = 3x^2 - 4x - 1$. Find the average value of $f$ over the interval $[2, 4]$.

3. Use Part I of the Fundamental Theorem of Calculus to find the derivative of the function

$$h(x) = \int_{2-7x}^{3} \frac{t^2}{1 + t} \, dt$$

4. Using complete sentences, state the definition of the definite integral. Please be sure to include all important details.

5. The graph of $f$ is given below. Evaluate each integral by interpreting it in terms of areas.

6. Evaluate each integral or state why it does not exist.

   (a) $\int \sin 3\theta \, d\theta$

   (b) $\int x\sqrt{x - 1} \, dx$

   (c) $\int 3x^4 \sqrt{2x^5 - 3} \, dx$

   (d) $\int_{-4}^{4} |x + 2| \, dx$

   (e) $\int_{1}^{4} \frac{2t^2 + \sqrt{t^3} - 3}{t^2} \, dt$

7. Find the area of the curve bounded by $y = x^2 - 2x$ and $y = 3x - 4$.

8. (SET UP ONLY) Find the area of the shaded region for $y = -\cos x$ and $y = \sin 2x$. 

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**Diagram:**

- A graph with axes labeled $x$ and $y$.
- The intervals of integration are marked: $[0, 3]$, $[3, 7]$, $[7, 12]$, and $[0, 12]$.

**Integrals:**

(a) $\int_{0}^{3} f(x) \, dx$

(b) $\int_{3}^{7} f(x) \, dx$

(c) $\int_{7}^{12} f(x) \, dx$

(d) $\int_{0}^{12} f(x) \, dx$
1. \( f(x) = \frac{1}{2}x^3 + \frac{1}{4}\cos 2x + 4x - \frac{29}{4} \)

2. 15

3. \( \frac{7(2 - 7x)^2}{3 - 7x} \)

4. see handout

5. (a) -6
   (b) 4
   (c) \( -\frac{21}{2} \)
   (d) \( 2\pi - \frac{33}{2} \)

6. (a) \( \frac{1}{12} (\cos 3\theta)^{-4} + C \)
   (b) \( \frac{2}{5} (x - 1)^{5/2} + \frac{2}{3} (x - 1)^{3/2} + C \)
   (c) \( \frac{9}{40} (2x^5 - 3)^{4/3} + C \)
   (d) 20
   (e) \( \frac{23}{4} \)

7. \( \frac{9}{2} \)

8. \( \int_0^{\pi/2} (\sin 2x + \cos x) \, dx + \int_{\pi/2}^{7\pi/6} (-\cos x - \sin 2x) \, dx \)