Find the general antiderivative for each:

1) $f(x) = 6x^2 + 6x - 1$

2) $g(x) = 5 \sin x$

3) $h(x) = \dfrac{4}{x} - 3e^x$

Name: _____

Class: Calculus

Period: _____

Week: 2

Assignment	Date Assigned	Score
Warmups		
p250-252 1,4-11, 16, 22, 23		
p271-272 1,3,9,13,19, 21,25, 29, 45, 47		
p271-272 5,7,11,15,16, 18, 20, 28, 30, 44, 51, 52, 56, 60, 61, 63, 67, 69		

Section 6.3 Differential Equations

ex: $f'(x) = 3x^2 + 6x - 5$ with $f(0) = 7$.

It's asking you to find the function $f(x)$.

$f(0) = 7$ is the initial condition.

STEP 1 : Calculate the antiderivative of $f'(x)$. This gives us $f(x)$.

$$f(x) = \frac{3x^3}{3} + \frac{6x^2}{2} - 5x + C$$

$$f(x) = x^3 + 3x^2 - 5x + C$$

STEP 2 : Plug in initial condition to find C.

$$f(0) = 7$$

$$0^3 + 3 \cdot 0^2 - 5 \cdot 0 + C = 7$$

$$C = 7$$

<u>STEP 3:</u> Write $f(x)$

$$f(x) = x^3 + 3x^2 - 5x + 7 \qquad \text{Particular Solution}$$

<u>ex</u>: $f'(x) = 5\cos x$ with $f\left(\frac{\pi}{2}\right) = -3$

$$f(x) = 5\sin x + C$$

$$5\sin\frac{\pi}{2} + C = -3$$

$$5 \cdot 1 + C = -3$$

$$C = -8$$

$$f(x) = 5\sin x - 8$$

<u>ex</u>: $\dfrac{dP}{dt} = 6e^t + 7 \qquad P(1) = -2 \qquad\qquad P'(t) = 6e^t + 7$

$\llcorner$ like $P'(t)$

$$\int 1\, dP = \int \left(6e^t + 7\right) dt \quad \leftarrow \text{separation of variables}$$

$$P = 6e^t + 7t + C$$

$$6e^1 + 7 \cdot 1 + C = -2$$

$$C = -9 - 6e$$

$$C \approx -25.31$$

$$P(t) = 6e^t + 7t - 25.31$$

Motion Problems

ex: A ball is thrown vertically from a height of 6 feet with an initial velocity of $60^{ft}/sec$. How high will the ball go? Use $a(t) = -32\,{}^{ft}/_{sec^2}$

We know velocity is the derivative of height

We know acceleration is the derivative of velocity.

So velocity is the antiderivative of acceleration.

so $v(t) = -32t + C$

$$v(0) = 60$$

$$-32 \cdot 0 + C = 60$$

$$C = 60$$

$$v(t) = -32t + 60$$

$h(t)$ is the antiderivative of $v(t)$

$$h(t) = -\frac{32t^2}{2} + 60t + C$$

$$h(t) = -16t^2 + 60t + 6$$

$$\llcorner h(0) = 6$$

highest height $v(t) = 0$

$$-32t + 60 = 0$$

$$-32t = -60$$

$$t = 1.875 \text{ seconds}$$

highest height $h(1.875) = -16 \cdot 1.875^2 + 60 \cdot 1.875 + 6$

$$\boxed{= 62.25 \text{ ft}}$$

p277   1-11 odd, 14, 15, 16, 18

$a(t) = -9.8 \text{ m/sec}^2$
for metric

$a(t) = -32 \text{ ft/sec}^2$
for America