DO NOW

5.1 Antiderivatives - Day 2

1. Solve the differential equation: $f'(x) = 5x$, $f(2) = 11$ (x ↓, y ↓ or F(x))

$\frac{dy}{dx} = 5x$

$dy = 5x\,dx$

$y = \int 5x\,dx$

$f(x) = 5\int x\,dx$

$f(x) = 5\left(\frac{x^2}{2}\right) + C$

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

* substitute $11 = \frac{5}{2}(2)^2 + C$

* Solve $11 = 10 + C$

$1 = C$

$\boxed{f(x) = \frac{5}{2}x^2 + 1}$

2. Solve the differential equation $f''(x) = x^2$ where $f'(0) = 6$ and $f(0) = 3$

$f'(x) = \int x^2\,dx$

$f'(x) = \frac{x^3}{3} + C$

$6 = \frac{0^3}{3} + C$

$\boxed{6 = C}$

$f'(x) = \frac{x^3}{3} + 6$

$f(x) = \int\left(\frac{x^3}{3} + 6\right)dx$

$f(x) = \frac{1}{3}\int x^3\,dx + \int 6\,dx$

$f(x) = \frac{1}{3}\left(\frac{x^4}{4}\right) + 6x + C$

$f(x) = \frac{1}{12}x^4 + 6x + C$

$3 = \frac{1}{12}(0)^4 + 6(0) + C$

$\boxed{3 = C}$

$\boxed{f(x) = \frac{1}{12}x^4 + 6x + 3}$

pg 293; 74 $\frac{dP}{dt} = k\sqrt{t}$; $0 \le t \le 10$

Find P(7)

* $P(0) = 500$
* $P(1) = 600$

$dP = k\sqrt{t}\,dt$

$P(t) = \int kt^{1/2}\,dt$

$P(t) = k\int t^{1/2}\,dt$

$P(t) = k\left(\frac{t^{3/2}}{\frac{3}{2}}\right) + C$

$P(t) = \frac{2}{3}kt^{3/2} + C$

* Recall $P(0) = 500$

$500 = \frac{2}{3}k(0)^{3/2} + C$

$500 = C$

$\therefore P(t) = \frac{2}{3}kt^{3/2} + 500$

* Recall $P(1) = 600$

$600 = \frac{2}{3}k(1^{3/2}) + 500$

$100 = \frac{2}{3}k$

$100\left(\frac{3}{2}\right) = k$

$150 = k$

$\therefore P(t) = \frac{2}{3}(150)t^{3/2} + 500$

$P(t) = 100t^{3/2} + 500$

Find P(7)

$P(7) = 100(7)^{3/2} + 500$

$P(7) \approx 2352$

$\boxed{\text{About 2352 bacteria}}$

HOMEWORK

pg 291 - 292; 16 - 44 even, 53, 55, 63, 65, 67, 70, 73, 77

See pg 290; Example 8