1. Suppose you are blowing up a balloon using an air pump whose output is 5000 cm^3 of air per second. When the radius of the balloon is 12 cm, how fast is it expanding?

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$$V = \frac{4}{3}\pi r^3$$

$$\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$$

$$5000 = 4\pi \cdot 12^2 \frac{dr}{dt}$$

$$\frac{dr}{dt} = \frac{5000}{4\pi \cdot 12^2} \approx 2.76 \text{ cm/s}$$

2. You are standing on the roof of a building which is 25 m tall. You accidentally drop your phone from the roof. How long will it take to hit the ground?

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$$s(t) = -4.9t^2 + v_0 t + s_0 \qquad v_0 = 0,\ s_0 = 25$$

$$= -4.9t^2 + 25 = 0$$

$$4.9t^2 = 25$$

$$t^2 = \frac{25}{4.9}$$

$$t \approx 2.26 \text{ s}$$

3. Find $\int \left(\frac{1}{x} - \frac{2}{x^4}\right) dx$.

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$$\int \left(\frac{1}{x} - 2x^{-4}\right) dx = \ln x - 2 \cdot \frac{-1}{3} x^{-3} + C$$

$$= \ln x + \frac{2}{3} x^{-3} + C$$

$$= \ln x + \frac{2}{3x^3} + C$$

4. Suppose you throw a baseball at an angle of 40° from the horizontal at a speed of 25 m/s. When the baseball leaves your hand, it is 2 m above the ground. Write the corresponding displacement equations. Do not solve.

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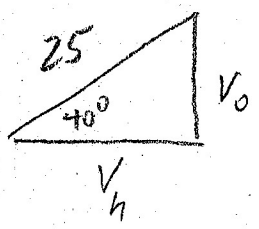

$y(t) = -4.9t^2 + 16.07t + 2$

$x(t) = 19.15t$

$\frac{V_0}{25} = \sin 40°$ $\quad$ $\frac{V_h}{25} = \cos 40°$

$V_0 \approx 16.07$ $\quad$ $V_h \approx 19.15$

5. Fine $\int (\sin(x) - \cos(x))\, dx$.

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$-\cos(x) - \sin(x) + C$

6. Solve the initial value problem $f'(x) = x^2 + x - 3$, $f(3) = -1$.

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

$= \int (x^2 + x - 3)\, dx$

$= \frac{1}{3}x^3 + \frac{1}{2}x^2 - 3x + C$

$\frac{1}{3}(3^3) + \frac{1}{2}(3^2) - 3\cdot 3 + C = 0$

$9 + \frac{9}{2} - 9 + C = 0$

$C = -\frac{9}{2}$

$f(x) = \frac{1}{3}x^3 + \frac{1}{2}x^2 - 3x - \frac{9}{2}$