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### 13.1 : Integrating $x^n$

$$1) a) 9x^{2+1} = \frac{9x^3}{3} = 3x^3 + c$$

$$b) 12x^{-3+1} = \frac{12x^{-2}}{-2} = -6x^{-2} + c$$

$$c) 6x^{7/2+1} = \frac{6x^{9/2}}{9/2} = \frac{12}{9}x^{9/2} + c$$

$$d) 25x + c$$

$$2) a) \frac{dy}{dx} = \sqrt{x} \Rightarrow x^{1/2+1} = \frac{x^{3/2}}{3/2} + c = \frac{2}{3}x^{3/2} + c$$

$$b) \frac{dy}{dx} = \frac{3}{3\sqrt{x}} = \frac{3}{x^{1/2}} = 3x^{-1/2+1} = \frac{3x^{1/2}}{1/2} = \frac{9}{2}x^{1/2} + c$$

$$c) 5^4\sqrt{x} = 5x^{5/4+1} = \frac{5x^{9/4}}{9/4} + c = \frac{20}{9}x^{9/4} + c$$

$$d) \frac{-1}{6\sqrt{x}} = -\frac{1}{6}x^{-1/2} = \frac{-\frac{1}{6}x^{1/2}}{1/2} + c = -\frac{1}{3}x^{1/2} + c$$

$$3) a) f'(x) = x^4 + x^3 - 5x + 6 \Rightarrow \frac{x^5}{5} + \frac{x^4}{4} - \frac{5x^2}{2} + 6x + c = \frac{1}{5}x^5 + \frac{1}{4}x^4 - \frac{5}{2}x^2 + 6x + c$$

$$b) 4x^2 + \frac{1}{3}x^{-4} = 5x^{-3}$$

$$\frac{4x^3}{3} + \frac{1}{3}x^{-1} - \frac{5x^{-2}}{-4} + c \rightarrow \frac{4}{3}x^3 - \frac{1}{3}x^{-1} + \frac{5}{2}x^{-2} + c$$

$$c) 3x^{-1/4} - 2x^{-5/4}$$

$$f(x) = \frac{3x^{3/4}}{3/4} - \frac{2x^{-1/4}}{1/4} \rightarrow 4x^{3/4} - 8x^{-1/4} + c$$

$$4) a) f'(x) = (4x+3)(4x+3) \rightarrow 16x^2 + 12x + 12x + 9 = 16x^2 + 24x + 9$$

$$b) f'(x) = 16x^2 + 24x + 9 \rightarrow \frac{16x^3}{3} + \frac{24x^2}{2} + 9x + c = \frac{16}{3}x^3 + 12x^2 + 9x + c$$

$$5) f'(x) = (3x-5)^2 \rightarrow 9x^2 - 30x + 25$$

$$f(x) = \frac{9x^3}{3} - \frac{30x^2}{2} + 25x + c = 3x^3 - 15x^2 + 25x + c$$

$$6) \frac{dy}{dx} = (1-3x^2)^2 \rightarrow (-3x+1)^2 = 9x^2 - 6x + 1$$

$$y = \frac{9x^3}{3} - \frac{6x^2}{2} + x + c = 3x^3 - 3x^2 + x + c$$

$$7) a) 4 \binom{3}{p} (-5x)^3$$

$$(4)(p)(-125x^3)$$

$$-500px^3 = -1000$$

$$p = 2$$

$$b) (p-5x)^2 (25x^2 - 10px + p^2)(25x^2 - 10px + p^2)$$

$$625x^4 - 2500px^3 + 25p^2x^2 - 2500px^3 - 100p^2x^2 - 10p^2x + 25p^2x^2 - 10p^2x + p^4$$

$$b) (2-5x)^4$$

$$h'(x) = (2-5x)^4$$

$$(2-5x)^2$$

$$(4-20x+25x^2)(4-20x+25x^2)$$

$$16-80x+100x^2-80x+400x^2-500x^3+100x^2-500x^3+625x^4$$

$$h'(x) = 625x^4 - 1000x^3 + 600x^2 - 160x + 16$$

$$h(x) = \frac{625x^5}{5} - \frac{1000x^4}{4} + \frac{600x^3}{3} - \frac{160x^2}{2} + 16x + c$$

$$125x^5 - 250x^4 + 200x^3 - 80x^2 + 16x + c$$

$$8) a) (4-2\sqrt{x})^2 \rightarrow (4-2\sqrt{x})(4-2\sqrt{x})$$

$$16 - 8\sqrt{x} - 8\sqrt{x} + 4x$$

$$= 4x - 16\sqrt{x} + 16$$

$$= 16 - 16\sqrt{x} + 4x$$

$$a - b\sqrt{x} + cx$$

$$b) f'(x) = 16 - 16\sqrt{x} + 4x$$

$$f(x) = 16x \quad f'(x) = 16 - 16x^{1/2} + 4x$$

$$f(x) = 16x - \frac{16x^{3/2}}{3/2} + \frac{4x^2}{2} + c = 16x - \frac{32}{3}x^{3/2} + 2x^2 + c$$

$$9) a) (3-2x)^8 \rightarrow 3^8 + {}^8C_1(3)^7(-2x) + {}^8C_2(3)^6(-2x)^2$$

$$65619 - 34992x + 81648x^2$$

$$b) g(x) = \frac{6561x}{2} - \frac{34992x^2}{2} + \frac{81648x^3}{3} + c$$

$$= 6561x - 17496x^2 + 27216x^3 + c$$