

7. Carbon-14 has a half-life of 5700 years. Consider a sample of fossilized wood that when alive would have contained 24g of C-14. It now contains 1.5g. How old is the sample?

$$1.5 = 24 \left(\frac{1}{2}\right)^{x/5700} \quad 0.0625 = \left(\frac{1}{2}\right)^{x/5700} \quad \ln(0.0625) = \ln\left(\frac{1}{2}\right)^{x/5700} \quad x = \frac{\ln(0.0625) \cdot 5700}{\ln\left(\frac{1}{2}\right)} = 22800 \text{ years}$$

8. The half-life of a radioactive element is 133 days, but your sample will not be useful to you after 65% of the radioactive nuclei originally present have disintegrated. About how many days can you use the sample?

$$0.35 = 100 \left(\frac{1}{2}\right)^{x/133} \quad \ln(0.35) = \ln(0.5)^{x/133} \quad \ln(0.35) = \frac{x}{133} \cdot \ln(0.5) \quad x = \frac{\ln(0.35) \cdot 133}{\ln(0.5)} = 82.65795411$$

82 days

### 6.7 COMBINATIONS AND COMPOSITIONS OF FUNCTIONS

If  $f(x) = x^2 - 1$ ,  $g(x) = 2x - 3$ , and  $h(x) = 1 - 4x$ , find the following functions, as well as any values indicated.

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

5.  $(g \cdot h)(x) = \frac{(2x - 3)(1 - 4x)}{2x - 8x^2 - 3 + 12x} = -8x^2 + 14x - 3$

2.  $(f - g)(3) = (3)^2 - 2(3) + 2 = 5$

6.  $(g \cdot h)(4) = -8(4)^2 + 14(4) - 3 = -75$

3.  $(f + h)(x) = \frac{(x^2 - 1) + (1 - 4x)}{x^2 - 1 + 1 - 4x} = x^2 - 4x$

7.  $\left(\frac{f}{g}\right)(x) = \frac{x^2 - 1}{2x - 3}$

4.  $(f + h)(-2) = (-2)^2 - 4(-2) = 12$

8.  $\left(\frac{f}{g}\right)(-1) = \frac{(-1)^2 - 1}{2(-1) - 3} = \frac{0}{-5} = 0$

Let  $f(x) = 2x - 1$ ,  $g(x) = 3x$ , and  $h(x) = x^2 + 1$ . Compute the following:

9.  $f(g(x)) = 2(3x) - 1 = 6x - 1$

12.  $f(g(-3)) = 2(3 \cdot -3) - 1 = 2(-9) - 1 = -17$

10.  $(h \circ g)(x) = (3x)^2 + 1 = 9x^2 + 1$

13.  $g(f(h(-6))) = 219$

$h(-6) = (-6)^2 + 1 = 37$

$f(37) = 2(37) - 1 = 73$

$g(73) = 3 \cdot 73 = 219$

11.  $h(f(9)) = (2 \cdot 9 - 1)^2 + 1 = 290$

For #'s 14 & 15,  $h(x) = (f \circ g)(x)$

14. Let  $h(x) = \sqrt{x - 5}$  and  $f(x) = \sqrt{x}$ , find  $g(x)$ .  $g(x) = x - 5$

15. Let  $h(x) = (5x + 1)^2 - (5x + 1)$  and  $f(x) = x^2 - x$ , find  $g(x)$ .  $g(x) = 5x + 1$