1.

$$\lim_{x\to 7}(f(x)+g(x)) = \lim_{x\to 7} f(x) + \lim_{x\to 7} g(x) = -4+9=5$$

2.

$$\lim_{x\to 5}(f(x))^2 = (\lim_{x\to 7} f(x)) \cdot (\lim_{x\to 7} g(x)) = -9\cdot -9 = 81$$

3.

$$\lim_{x\to 3} \frac{2f(x)}{g(x)-f(x)} = \frac{2\lim_{x\to 3} f(x)}{\lim_{x\to 3} g(x) - \lim_{x\to 3} f(x)} = \frac{2\cdot -3}{10-(-3)} = \frac{-6}{13}$$

4.

$$\lim_{x\to 1}(x+4)^4(x^2-4) = (1+4)^4(1^2-4) = -1875$$

5.

$$\lim_{x\to 3} \frac{x^3-5}{x^2-2} = \frac{3^3-5}{3^2-2} = \frac{22}{7}$$

6.

$$\lim_{x\to 7} \frac{\sqrt{x+2}-3}{x-7} = \lim_{x\to 7} \frac{\sqrt{x+2}-3}{x-7} \cdot \frac{\sqrt{x+2}+3}{\sqrt{x+2}+3} = \lim_{x\to 7} \frac{1}{\sqrt{x+2}+3} = \frac{1}{\sqrt{7+2}+3} = \frac{1}{6}$$

7.

$$\lim_{x\to 0} \frac{(10+x)^{-1}-10^{-1}}{x} = \lim_{x\to 0} \frac{\frac{1}{10+x}-\frac{1}{10}}{x} = \lim_{x\to 0} \frac{-1}{10(10+x)} = \frac{-1}{100}$$

8.

$$\lim_{x\to -3} \frac{\frac{1}{3}+\frac{1}{x}}{x+3} = \lim_{x\to -3} \frac{1}{3x} = \frac{1}{-9}$$

9.

$$\lim_{x\to 0} \left(\frac{1}{x} - \frac{8}{x^2+8x}\right) = \lim_{x\to 0} \frac{x}{x^2+8x} = \lim_{x\to 0} \frac{1}{x+8} = \frac{1}{8}$$

10. Since $8x \le f(x) \le x^3+7$ for all x, and

$$\lim_{x\to 1} 8x = \lim_{x\to 1} x^3+7 = 8,$$

the Squeeze Theorem tells us that

$$\lim_{x\to 1} f(x) = 8$$

11. Note that for all x, $-1 \leq \cos\frac{2}{x} \leq 1$, so $-x^5 \leq x^5 \cos\frac{2}{x} \leq x^5$. Also,

$$\lim_{x\to 0} -x^5 = \lim_{x\to 0} x^5 = 0,$$

so using the Squeeze Theorem we have

$$\lim_{x\to 0} x^5 \cos\frac{2}{x} = 0$$

12.

$$(i) \lim_{x\to 9^+} g(x) = 9 - 9 = 0$$

$$(ii) \lim_{x\to 0} g(x) = 9 - 0^2 = 9$$

$$(iii) \lim_{x\to -9} g(x) \text{ DNE, since } \lim_{x\to -9^-} = 9 \neq -72 = \lim_{x\to -9^+}$$

13.

$$\lim_{x\to 4} f(x) = f(4)$$

14.

$$\lim_{x\to 1^+} f(x) = 6$$

15. 'The temperature at a specific time as a function of the distance due west from New York City', 'The temperature at a specific location as a function of time', and 'The altitude of an airplane (measured from sea level) during a flight from New York to London as a function of distance travelled' are the continuous functions.

16. The first function is continuous, since its limit at 4 is 1/2 coming from either the right or the left. The second function, however, does not have a limit at 4, so it is discontinuous.

17. $f(x) = e^{\sqrt{|x|}} \cos 6x$ is continous everywhere, as is $f(x) = e^x \cos 6x$. $f(x) = \cos\frac{6}{x}$ does not exist at 0, and $f(x) = e^{\sqrt{x}} \cos 6x$ does not exist for $x < 0$.

18. We require $x^4 - 256 > 0$. Solving, we get $x > 4$ or $x < -4$, so the domain is $(-\infty, -4) \cup (4, \infty)$.

19.

$$\lim_{x\to -14\pi} \sin(x + 6\sin x) = \sin(-14\pi + 6\sin(-14\pi)) = \sin(-14\pi + 6\cdot 0) = \sin(-14\pi) = 0$$

20. The function is discontinous at 0 and at 5, since at those values the left and right limits are not equal.

21. Requiring that the left and right limits at 2 be equal is expressed by the equation $2c + 3 = 4c - 5$. Solving, we see that $c = 4$.