Question 1: Find the following derivatives (Take care to use proper notation; it is not necessary to simplify your answers):

(a) $f(x) = 4x^3 \cos(x)$

[2]

(b) $y = \dfrac{\sqrt{x}}{1 + \tan(x)}$

[2]

(c) $g(t) = t^2 \sec(1/t)$

[3]

(d) $y = \dfrac{x^2}{\left(1 + \dfrac{1}{x^2}\right)}$

[3]

Question 2: Find the following derivatives (Take care to use proper notation; it is not necessary to simplify your answers):

(a) $f(x) = \cos^4(1 - 2x)$

[2]

(b) $y = \dfrac{1}{2}\cos(2x)\sqrt{1 + \sin(2x)}$

[2]

(c) $g(t) = t^{-2}(4 + t^3)^7$

[3]

(d) $y = \sqrt{\tan\left(\dfrac{x}{1+x}\right)}$

[3]

Question 3: Find $\frac{dy}{dx}$ by implicit differentiation:

$$x^4 + \sin(y) = x^3 y^2$$

[5]

Question 4: Find an equation of the tangent line to

$$y^4 - 4y^2 = x^4 - 9x^2$$

at the point $(-3, 2)$.

[5]

Question 5: Sand falls from a conveyor belt onto a cone shaped pile at the rate of 10 m^3/min. The pile of sand grows in such a way that the height of the pile is always 3/8 of the base diameter. How fast is the height of the pile growing when the pile is 4 m tall? (Recall, the volume of a cone of height h and base radius r is $V = \pi r^2 h/3$.)

[10]

Question 6: For this question consider the function $f(x) = (1+x)^k$ where k is a constant.

(a) Find $L(x)$, the linearization of f at $a = 0$. (Your answer should have k in it.)

[4]

(b) Use part (a) to approximate $(1.1)^\pi$.

[1]

Question 7: The side length of a cube was measured to be 10 cm with a maximum measurement error of 1/100 cm. Estimate the maximum <u>relative</u> error in the calculated surface area of the cube.

[5]