CALCULUS
Linear approximation
OLD2

0540-1. Find the linearization of

OLD2

$$f(x) = 5x^3 - 2x$$

at $x = 3$.

That is, find m and a s.t. the linear function

$$L(x) = a + m(x - 3)$$

has the same 1-jet at $x = 3$ as does $f(x)$.

That is, find m and a s.t. the linear function

$$L(x) = a + m(x - 3)$$

satisfies: $L(3) = f(3)$ and $L'(3) = f'(3)$.

0540-2. Find the linearization of

OLD2

$$f(x) = \tan x$$

at $x = \pi/4$.

That is, find m and a s.t. the linear function

$$L(x) = a + m(x - (\pi/4))$$

has the same 1-jet at $x = \pi/4$ as does $f(x)$.

That is, find m and a s.t. the linear function

$$L(x) = a + m(x - (\pi/4))$$

satisfies: $L(\pi/4) = f(\pi/4)$

and $L'(\pi/4) = f'(\pi/4)$.

0540-3. OLD2 Let $y = \dfrac{e^x \cos x}{2x^2 + 3x - 5}$.

Compute $\triangle y$ and dy.

0540-4. OLD2 Let $w = \dfrac{u + 4}{\sin(2u + 8)}$.

Compute $\triangle w$ and dw.

0540-5. OLD2 Let $z = \dfrac{e^{3h^2+2h}}{\cos(h + 5)}$.

a. Compute $[\triangle z]_{h:\to 0, \triangle h:\to 0.0002}$.

b. Compute $[dz]_{h:\to 0, dh:\to 0.0002}$.

0540-6. a. Compute $(3.0002)^7$.
OLD2

b. Approx. $(3.0002)^7$ by differentials.

c. Let $L(x)$ be the linearization of $f(x) = x^7$ at $x = 3$.

Compute $L(3.0002)$.

0540-7. Let θ be the number of radians in 59.9°.
OLD2

Approximate $\cos\theta$ by differentials.

0540-8. Approx. $e^{0.004}$ by differentials.
OLD2

0540-9. We need to paint a ball whose radius is 10 meters.
OLD2

The coat of paint is to be 0.001 meters thick, so, after painting, the radius will be 10.001 meters.

a. Let $V = \frac{4}{3}\pi r^3$. Compute ΔV and dV.

b. Using ΔV, compute the exact volume of paint that will be needed.

c. Using dV, estimate the volume of paint that will be needed.

d. Compute 0.001 times the surface area of a ball of radius 10 meters.

0540-10. A square based pyramid whose sides are equilateral triangles is called a J_1 **(Johnson$_1$) solid**; its edges all have the same length. If that length is s, then its volume is $\frac{\sqrt{2}}{6}s^3$.
OLD2

Pharaoh asks us to build a pyramid in the shape of a J_1 solid, whose edge length is 500 ± 1 feet.

Up to some error, its volume will be $\frac{\sqrt{2}}{6}(500)^3$ cubic feet.

Using differentials, estimate that error.