CALCULUS
Linear approximation
OLD

0540-1. Find the linearization of

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

at $x = 2$.

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

$$L(x) = a + m(x - 2)$$

has the same 1-jet at $x = 2$ as does $f(x)$.

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

$$L(x) = a + m(x - 2)$$

satisfies: $L(2) = f(2)$ and $L'(2) = f'(2)$.

0540-2. Find the linearization of

OLD

$$f(x) = \sec x$$

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. Let $y = \dfrac{x^2 \cos x}{e^x}$.
OLD

Compute $\triangle y$ and dy.

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

Compute $\triangle u$ and du.

0540-5. Let $z = \dfrac{e^{2v^2}}{\tan(4v-1)}$.
OLD

a. Compute $[\triangle z]_{v:\to 0, \triangle v:\to 0.001}$.

b. Compute $[dz]_{v:\to 0, dv:\to 0.001}$.

0540-6. a. Compute $(3.001)^8$.
OLD

b. Approx. $(3.001)^8$ by differentials.

c. Let $L(x)$ be the linearization of $f(x) = x^8$ at $x = 3$.

Compute $L(3.001)$.

0540-7. Let θ be the number of radians in 29.9°.
OLD

Approximate $\cos\theta$ by differentials.

0540-8. Approx. $e^{0.05}$ by differentials.
OLD

0540-9. We need to paint a cube whose side length is 10 meters.
OLD

The coat of paint is to be 0.001 meters thick, so, after painting, the sides will have length 10.002 meters.

a. Let $V = s^3$. Compute $\triangle V$ and dV.

b. Using $\triangle V$, 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 cube of side length 10 meters.

0540-10. A regular tetrahedron of height h
OLD
has volume $\frac{\sqrt{3}}{8}h^3$.

Pharaoh asks us to build a pyramid in the shape of a regular tetrahedron, whose height is 300 ± 1 feet.

Up to some error, its volume will be $\frac{\sqrt{3}}{8}(300)^3$ cubic feet.

Using differentials, estimate that error.