Q.1 a) Using the limit definition of the derivative show
that $\frac{d}{dx} \sin(x) = \cos(x)$

b) Find the derivative of $f(x) = \tan(\ln(3x + e^x))$

c) Find the derivative of $g(t) = \sin^{-1}\left(\dfrac{25^t}{1 + t^3}\right)$

2 a) Find the slope of the tangent curve at the point $(1, 3)$

$$x^5 - y^2 \ln(x) + 2y = 7$$

b) Use linear approximation to approximate at $x = 1.1$

4. A poster must have a total area of 600 cm^2. It will have
a margin of 6 cm on the sides and 4cm on the top and bottom
Find the dimensions of the poster with the smallest area (the area
inside the margins)

$6t = f(t)$

5. Let $6.4 f(t)$ represent the rate of nitrogen oxide emissions
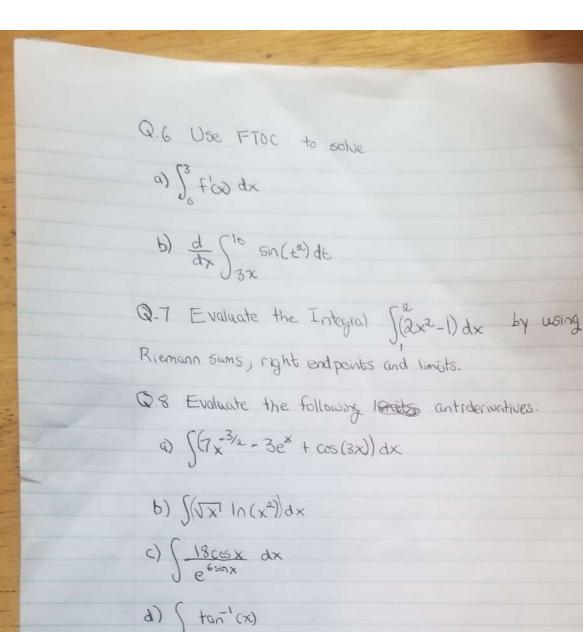(in kilotonnes per year) where t is measured in years since 2000.

a) What does $\int_0^6 f(t)\, dt$ represent in this context.

b) Use right-end point Riemann sum approximation to approximate
$\int_0^6 f(t)\, dt$, with 6 sub-intervals

c) Is the answer from b) and an over approximation or under approx?
explain why.

Q.6 Use FTOC to solve

a) $\int_0^3 f'(x)\,dx$

b) $\frac{d}{dx}\int_{3x}^{10}\sin(t^2)\,dt$

Q.7 Evaluate the Integral $\int_1^2(2x^2-1)\,dx$ by using Riemann sums, right end points and limits.

Q.8 Evaluate the following limits antiderivatives:

a) $\int(7x^{-3/2}-3e^x+\cos(3x))\,dx$

b) $\int(\sqrt{x}\,\ln(x^2))\,dx$

c) $\int\frac{18\cos x}{e^{6\sin x}}\,dx$

d) $\int\tan^{-1}(x)$

9. Let $f(x)=\frac{11x-6}{(x-2)(x^2+4)}$

a) Determine the partial fraction decomposition of $f(x)$.

b) Use your result from part a) to evaluate $\int f(x)\,dx$

10. The region bounded by $y=x^2$ and $y=5x-4$ is to be rotated about the line $y=-2$ and $x=-3$

a) Sketch a graph of the bounded region

b) Write the integral that gives the volume of revolution about the line $y=-2$. <u>Do not evaluate</u>

c) Write the integral that gives the volume of revolution about the line $x=-3$. <u>Do not evaluate</u>

11. The two series below are convergent. Find the value of each series and simplify your answer.

a) $\sum\limits_{n=1}^{\infty} \dfrac{3}{7^{n+1}}$

b) $\sum\limits_{n=1}^{\infty} \dfrac{1}{(n+2)(n+3)}$

Hint
Use partial Fractions

12. For $f(x) = \dfrac{x}{3-4x}$ Find a power series centered at 0 starting at $n=0$ and determine the radius of convergence and the interval of convergence

13. Bonus: Evaluate $\displaystyle\int \dfrac{1}{\sqrt{2x^2}+1}\, dx$