Question 1:

(a)[5 points] The function $f(x)$ has the following values:

x	0	1/2	1	3/2	2
$f(x)$	-4	2	-2	a	-6

Notice in this table that $f(3/2) = a$. Using all of the data above and Simpson's Rule resulted in the approximation $\int_0^2 f(x)\,dx \approx 1$. Determine the value of a.

(b)[5 points] Suppose Simpson's rule on 12 subintervals is used to approximate $\int_0^{12} g(x)\,dx$, where $g(x) = x^3 + px + q$ for some constants p and q. Determine an error bound for the approximation. (Recall, the error in using Simpson's Rule to approximate $\int_a^b g(x)\,dx$ is at most $\dfrac{K(b-a)^5}{180n^4}$, where $|g^{(4)}(x)| \le K$ on $[a, b]$.) The answer is simple, and surprising.

Question 2:

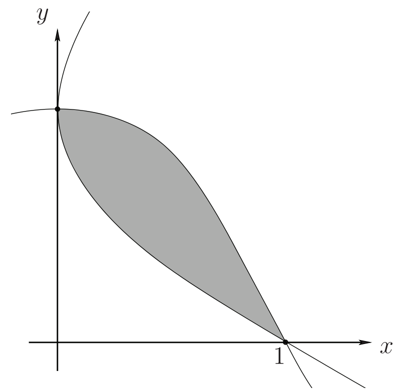
(a)[5 points] Evaluate the improper integral. Clearly show all steps including any required limits, and state, based on your answer, whether the integral converges or diverges:

$$\int_0^{\infty} \frac{x}{(1+2x^2)^{3/2}}\,dx$$

(b)[5 points] Use the Comparison Theorem to determine if $\int_1^{\infty} \frac{x^2}{x^4+e^x}\,dx$ converges or diverges.

Question 3:

(a)[5 points] Determine the area of region bounded by the two curves $y = 1 - x^4$ and $x = (y-1)^2$:



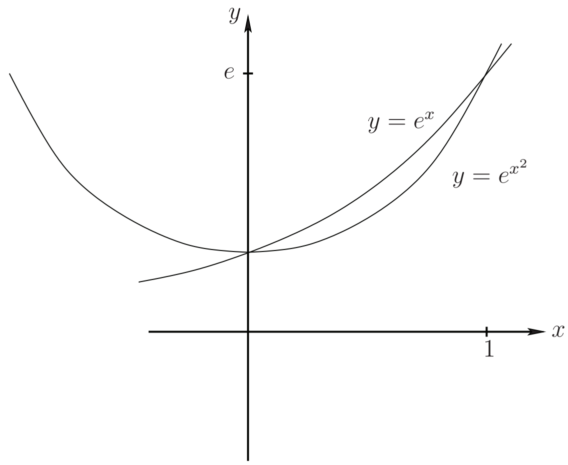
(b)[5 points] A pyramid has height 3 m and a square base of side length 2 m. Determine the volume of the pyramid.

Question 4:

(a)[5 points] The top half of a circle of radius r is described by the curve $y = \sqrt{r^2 - x^2}$, $-r \leq x \leq r$. Rotate this curve about the x-axis and determine volume of the resulting sphere.

(b)[5 points] The region between $y = \cos x$ and $y = \sin x$ on the interval $[0, \pi/4]$ is rotated about the line $y = 2$. Set up but do not evaluate an integral representing the volume of the resulting solid. Disks would work best here.

Question 5: This question deals with the functions $y = e^{x^2}$ and $y = e^x$. The following may be helpful:



(a)[5 points] The region bounded by $y = e^{x^2}$, the x-axis, $x = 0$ and $x = 1$ is rotated about the y-axis. Determine the volume of the resulting solid. Cylindrical shells would be best here.

(b)[5 points] The region bounded between $y = e^{x^2}$ and $y = e^x$ is rotated about the line $y = -1$. Set up but do not evaluate an integral representing the volume of the resulting solid. Use disks or cylindrical shells, whichever you prefer.