

Show **ALL** work for credit; be neat; and use only **ONE** side of each page of paper. Do **NOT** write on this page. Calculators can be used for graphing and calculating only. Give exact answers when possible.

Helpful facts:

$$\frac{cx + d}{(x - a)(x - b)} = \frac{1}{a - b} \left(\frac{d + ca}{x - a} - \frac{d + cb}{x - b} \right)$$

$$\cos(ax) \sin(bx) = \frac{1}{2} (\sin((a + b)x) - \sin((a - b)x))$$

$$\sin(ax) \sin(bx) = \frac{1}{2} (-\cos((a + b)x) + \cos((a - b)x))$$

$$\cos(ax) \cos(bx) = \frac{1}{2} (\cos((a + b)x) + \cos((a - b)x))$$

$$\int \frac{dx}{a^2 + x^2} = \frac{1}{a} \arctan \frac{x}{a} + C \quad \int \frac{dx}{\sqrt{a^2 - x^2}} = \arcsin \frac{x}{a} + C$$

$$\int e^{ax} \sin(bx) dx = \frac{1}{a^2 + b^2} (ae^{ax} \sin(bx) - be^{ax} \cos(bx)) + C$$

$$\int e^{ax} \cos(bx) dx = \frac{1}{a^2 + b^2} (ae^{ax} \cos(bx) + be^{ax} \sin(bx)) + C$$

$$\sin^2 x = \frac{1}{2} (1 - \cos 2x) \quad \cos^2 x = \frac{1}{2} (1 + \cos 2x)$$

1. Show all work needed to evaluate

$$\int \frac{x^3 + x + 1}{x^2} dx$$

2. Show all work needed to evaluate

$$\int y \sin y dy$$

3. Show all work needed to evaluate

$$\int_{-\pi}^{\pi} e^{2x} \sin 2x dx$$

4. Show all work needed to evaluate

$$\int \frac{2^t}{2^t + 1} dt$$

5. Show all work needed to evaluate

$$\int_1^3 x(x^2 + 1)^{70} dx$$

6. For both integrals arrange $LEFT(n)$, $RIGHT(n)$, $MID(n)$, $TRAP(n)$ and the actual value of the integral in increasing order.

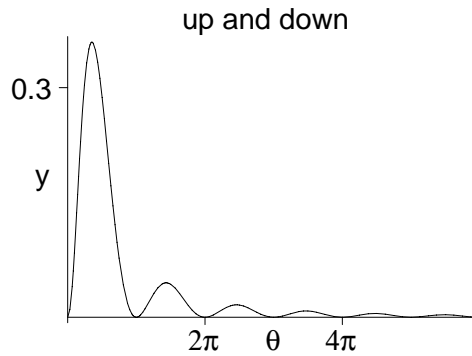
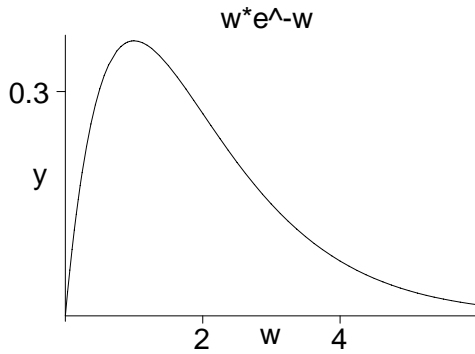
$$\int_0^5 e^x dx \quad \int_1^9 \ln x dx$$

There is more test on the otherside

Welcome to side two

7. Decide if the given integral converges or diverges. If the integral converges find its value. (see graph below.)

$$\int_0^{\infty} w e^{-w} dw$$

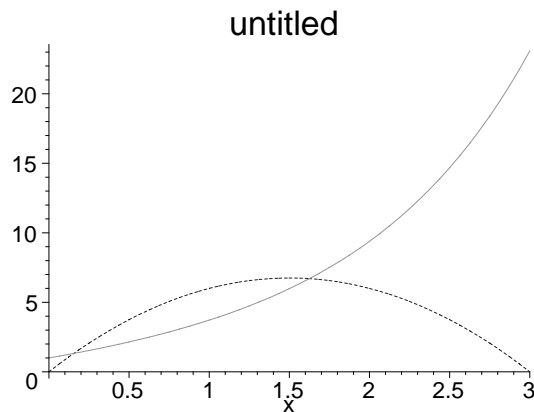


8. Decide if the given integral converges or diverges. If the integral converges find its value or a bound for its value. (see graph above.)

$$\int_1^{\infty} \frac{\sin^2 \theta}{\theta^2 + 1} d\theta$$

9. Find the 8 errors in the following Maple command. Assume that a restart command has just been given or equivalently that this is the very first line typed into Maple.

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▷ a=3: f:=x+exp^x; plot([f,3x(a-x)],x=0..3;color=[green,BLUE],title="untitled");
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10. How you might come up with the midpoint rule from the left sum rule and the calculator problem.

- Show $LEFT(2n) = (LEFT(n) + MID(n))/2$.
- Suppose that the approximation of the true value is twice as good for $LEFT(2n)$ as it is for $LEFT(n)$, show the true value of the integral is $MID(n)$.
- Pull out your calculator and use it to find $TRAP(32)$ to five decimals for

$$\int_0^{100} \arctan x dx$$