This test is closed-book and closed-notes. No calculator is allowed for this test. For full credit show all of your work (legibly!), unless otherwise specified. While integrals must be fully calculated, it is not necessary to arithmetically or algebraically simplify the results: common trigonometric calculations, however, must be completely evaluated.

The problems are in no particular order, and it is suggested that you look at all of them before beginning to answer any.

1. **(20 points)** Evaluate the following integrals:

   (a) **(10 points)** $\int \frac{dt}{t^2+2t+17}$

   (b) **(10 points)** $\int \frac{x+6}{x(x-3)(x+2)} ds$

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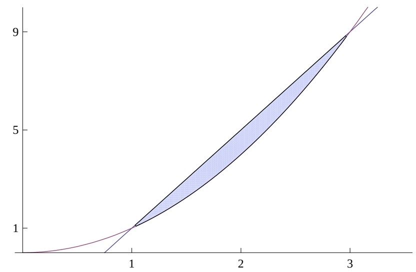
2. **(20 points)** Evaluate the following integrals:

   (a) **(10 points)** $\int t^3\sqrt{4-t^2}dt$

   (b) **(10 points)** $\int \frac{4y}{\sqrt{y^2+9}}dy$

3. **(10 points)** The region shown below is the area between the curves $y = 4x - 3$ and $y = x^2$.

   (a) **(5 points)** Find the area of this region.



   (b) **(5 points)** Find the volume of the solid produced by rotating this region around the x-axis.

4. **(20 points)** Evaluate the following integrals:

   (a) **(10 points)** $\int (x^2 - 2x)e^x dx$

   (b) **(10 points)** $\int 4x \sin 5x dx$

5. **(15 points)** Evaluate the following integrals:

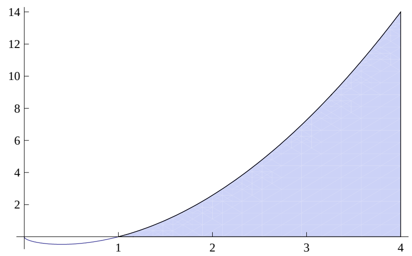
   (a) **(5 points)** $\int \sin x e^{\cos x} dx$

   (b) **(5 points)** $\int \tan^6 \theta \sec^2 \theta d\theta$

   (c) **(5 points)** $\int_1^2 x^3 e^{\left(x^4\right)} dt$

6. **(15 points)** The region shown below is the area under the curve $y = x^2 - \sqrt{x}$ from $x = 1$ to $x = 4$.

   (a) **(5 points)** Construct, but do not evaluate, an integral representing the volume of the solid produced by rotating this region around the x-axis.



   (b) **(5 points)** Construct, but do not evaluate, an integral representing the volume of the solid produced by rotating this figure around the y-axis.

   (c) **(5 points)** Calculate the average value of the function $f(x) = x^2 - \sqrt{x}$ on the interval $[1, 4]$.

7. **(5 point bonus)** On the back of this page, evaluate the integral $\int e^{kx} \cos(\ell x) dx$, where k and ℓ are constants.