

Name: \_\_\_\_\_

1. (10 pts.) Find all roots of  $f$  in the unit disc and determine their multiplicity.

(a)  $f(z) = \sin(2z) - 1$

(b)  $f(z) = e^{4z} + 1$

2. (10 pts.) Integrate  $f(z) dz$  along the straight line segment from  $1 - i$  to  $i$ .

(a)  $f(z) = \operatorname{Im} z$

(b)  $f(z) = \bar{z}z$

3. (20 pts.) Integrate around the unit circle once counterclockwise.

(a)  $\int \frac{dz}{i + 2z}$     (b)  $\int \frac{dz}{z^3 + 2z^2}$     (c)  $\int \frac{\exp(z^2)}{z^7} dz$     (d)  $\int \frac{dz}{z \sin z}$

4. (10 pts.) Show that all three roots of  $p(z) = z^3 + z - 3$  lie in the annulus  $1 < |z| < 2$ .

| 1 | 2 | 3 | 4 | total (50) | % |
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