

## CO2013: Complex Analysis, Quiz-3, Fall 2016

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Notice:

- a) *Term grading policy: Quiz-3*  $\times 10\%$ .
- b) **Total 100 points** in this exam.
- c) **Exam Time: 10:00AM–11:50AM**, Dec. 19, 2016.

1. (10 pts) What is the order of the pole of

$$f(z) = \frac{1}{(6 \sin z - 1 + z^3)^2}.$$

2. (10 pts) Suppose that  $f(z)$  is analytic and has a zero of order  $m$  at  $z = z_0$ . Let  $C : |z - z_0| = 1$  in positively oriented direction. Evaluate

$$\oint_C \frac{f'(z)}{f(z)} dz.$$

3. (20 pts) Evaluate each of the following contour integrals with positive orientation:

(a)  $\oint_{|z|=2} \tan z dz,$

(b)  $\oint_{|z|=1} \frac{dz}{z \sin z},$

(c)  $\oint_{|z+1-i|=1} \frac{dz}{z^2 + z + 1},$

(d)  $\oint_{|z|=1} z^2 \sin\left(\frac{1}{2z}\right) dz.$

4. (60 pts) Evaluate each of the following integrals:

(a)  $\int_{-\pi}^{\pi} \frac{d\theta}{1 + \sin^2 \theta},$

(b)  $\int_0^{2\pi} e^{\cos \theta} \cos(n\theta - \sin \theta) d\theta,$

(c) P.V.  $\int_{-\infty}^{\infty} \frac{\cos 2x}{x - 3i} dx,$

(d)  $\int_0^{\infty} \frac{\cos x}{x^4 - 1} dx.$