In Problems 1–22, use Theorems, when appropriate, to evaluate the given integral along the indicated closed contour(s).

1. $\oint_C \dfrac{4}{z-3i}\, dz;\ |z|=5$

2. $\oint_C \dfrac{z^2}{(z-3i)^2}\, dz;\ |z|=5$

3. $\oint_C \dfrac{e^z}{z-\pi i}\, dz;\ |z|=4$

4. $\oint_C \dfrac{1+e^z}{z}\, dz;\ |z|=1$

5. $\oint_C \dfrac{z^2-3z+4i}{z+2i}\, dz;\ |z|=3$

6. $\oint_C \dfrac{\cos z}{3z-\pi}\, dz;\ |z|=1.1$

7. $\oint_C \dfrac{z^2}{z^2+4}\, dz;$ **(a)** $|z-i|=2$, **(b)** $|z+2i|=1$

8. $\oint_C \dfrac{z^2+3z+2i}{z^2+3z-4}\, dz;$ **(a)** $|z|=2$, **(b)** $|z+5|=\frac{3}{2}$

9. $\oint_C \dfrac{z^2+4}{z^2-5iz-4}\, dz;\ |z-3i|=1.3$

10. $\oint_C \dfrac{\sin z}{z^2+\pi^2}\, dz;\ |z-2i|=2$

11. $\oint_C \dfrac{e^{z^2}}{(z-i)^3}\, dz;\ |z-i|=1$

12. $\oint_C \dfrac{z}{(z+i)^4}\, dz;\ |z|=2$

13. $\oint_C \dfrac{\cos 2z}{z^5}\, dz;\ |z|=1$

14. $\oint_C \dfrac{e^{-z}\sin z}{z^3}\, dz;\ |z-1|=3$

15. $\oint_C \dfrac{2z+5}{z^2-2z}\, dz;$ **(a)** $|z|=\frac{1}{2}$, **(b)** $|z+1|=2$ **(c)** $|z-3|=2$, **(d)** $|z+2i|=1$

16. $\oint_C \dfrac{z}{(z-1)(z-2)}\, dz;$ **(a)** $|z|=\frac{1}{2}$, **(b)** $|z+1|=1$ **(c)** $|z-1|=\frac{1}{2}$, **(d)** $|z|=4$

17. $\oint_C \dfrac{z+2}{z^2(z-1-i)}\, dz;$ **(a)** $|z|=1$, **(b)** $|z-1-i|=1$

18. $\oint_C \dfrac{1}{z^3(z-4)}\, dz;$ **(a)** $|z|=1$, **(b)** $|z-2|=1$

19. $\oint_C \left(\dfrac{e^{2iz}}{z^4}-\dfrac{z^4}{(z-i)^3}\right) dz;\ |z|=6$

20. $\oint_C \left(\dfrac{\cosh z}{(z-\pi)^3}-\dfrac{\sin^2 z}{(2z-\pi)^3}\right) dz;\ |z|=3$

21. $\oint_C \dfrac{1}{z^3(z-1)^2}\, dz;\ |z-2|=5$

22. $\oint_C \dfrac{1}{z^2(z^2+1)}\, dz;\ |z-i|=\frac{3}{2}$