There are some suggested tests here. The convergence claims are correct, but you may come up with alternative testing strategies.

Developing your intuition: For each of the following series, guess if it diverges, converges conditionally or converges absolutely. Keep in mind that you must answer two separate questions: 1. Does the series converge? and 2. Does the series converge absolutely? Name the test(s) you would use to answer each of these questions. Usually you are required to give a detailed solution, but for this worksheet, just briefly describe your overall strategy.

1. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n(n+\frac{1}{2})}{n-\frac{1}{2}}$

   Diverges

   Divergence test

2. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n n}{e^n}$

   Converges Absolutely

   Ratio test

3. $\displaystyle\sum_{n=1}^{\infty} \frac{2^n}{n!}$

   Converges absolutely

   Ratio test

4. $\displaystyle\sum_{n=1}^{\infty} \frac{(\sin n)2^n}{n!}$

   Converges absolutely

   Ratio test

5. $\displaystyle\sum_{n=2}^{\infty} \frac{(-1)^n(n^3+1)}{n^4+n-4}$

   Converges conditionally

   Alt. series test + limit comparison to $\sum \frac{1}{n}$

6. $\displaystyle\sum_{n=1}^{\infty} \frac{\cos^2 n}{n^{3/2}}$

   Converges absolutely

   Direct comparison to $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n^{3/2}}$

7. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^3+n}$

   Converges absolutely

   Direct comparison to $\sum \frac{1}{n^3}$

   can be used on $\sum \left|\frac{(-1)^{n+1}}{n^3+n}\right|$

8. $\displaystyle\sum_{n=2}^{\infty} \frac{(-1)^n \arctan n}{\sqrt{n}}$

   Converges conditionally

   Alt. series test and

   Direct or limit comparison $\sum \frac{1}{n^{1/2}}$

9. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n \ln n}{n^2}$

   Converges absolutely.

   Can compare $\sum \left|\frac{(-1)^n \ln n}{n^2}\right|$

   to $\sum \frac{1}{n^{3/2}}$ if you show $\ln n < \sqrt{n}$

10. $\displaystyle\sum_{n=2}^{\infty} \frac{(-1)^n n}{(\ln n)^2}$

    Diverges. Divergence test on $\sum \left|\frac{(-1)^n n}{(\ln n)^2}\right|$

11. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n \sqrt{n^7+n}}{\sqrt{n^9+n^5}}$

Converges conditionally
Alt. series test +
limit comparison to $\sum \frac{1}{n}$

12. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n \sqrt{n^7+n}}{\sqrt{n^{10}+n^5}}$

Converges absolutely
Alt. series + limit
Comparison to $\sum \frac{1}{n^{3/2}}$

13. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n\, 10n^2}{n^4+1}$

Converges absolutely
Alt. series test +
limit comparison to
$\sum \frac{1}{n^2}$

14. $\displaystyle\sum_{n=2}^{\infty} \frac{1}{n\sqrt{\ln n}}$

Diverges by Integral
test

15. $\displaystyle\sum_{n=1}^{\infty} \frac{n(-2)^n}{n!}$

Converges
absolutely
ratio test

16. $\displaystyle\sum_{n=1}^{\infty} \frac{2-5^n}{11^{n-1}(-1)^n}$

Converges absolutely.
This is the sum of two
convergent geometric series
with $|r_1| = \frac{1}{11}$, $|r_2| = \frac{5}{11}$

17. $\displaystyle\sum_{n=1}^{\infty} \sqrt{n}\,2^{n+1}$

Diverges by Divergence
test

18. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{4n^5+n^4-1}}$

Converges absolutely
Alt. series test + limit
comparison to $\sum \frac{1}{n^{5/2}}$

19. $\displaystyle\sum_{n=1}^{\infty} (-1)^{n+1} \frac{3^n\, n!}{1\cdot 3\cdot 5\cdot 7 \ldots (2n-1)}$

Diverges, ratio test

20. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n \sin(n^3)}{2^n}$

Converges absolutely
Compare $\sum \left|\frac{(-1)^n \sin(n^3)}{2^n}\right|$ to $\sum \frac{1}{2^n}$

21. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n\, n!}{e^{n^2}}$

Converges
absolutely
Ratio test