

Name _____ Score _____ Teacher _____ Date _____

Taylor and Maclaurin Polynomials

Build each requested polynomial from exact derivative coefficients. Show the center and keep factorial coefficients exact.

1. Find the Taylor polynomial through order 5 for $f(x)=\ln(x)$ centered at $a = 1$.

2. Find the Taylor polynomial through order 5 for $f(x)=\sin(x)$ centered at $a = 0$.

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Taylor and Maclaurin Polynomials

Build each requested polynomial from exact derivative coefficients. Show the center and keep factorial coefficients exact.

3. Find the Taylor polynomial through order 5 for $f(x)=1/x$ centered at $a = 1$.

4. Find the Taylor polynomial through order 5 for $f(x)=e^x$ centered at $a = 0$.

Math Sheet

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Taylor and Maclaurin Polynomials

Build each requested polynomial from exact derivative coefficients. Show the center and keep factorial coefficients exact.

5. Find the Taylor polynomial through order 4 for $f(x)=\cos(x)$ centered at $a = 0$.

6. Find the Taylor polynomial through order 4 for $f(x)=e^x$ centered at $a = 1$.

Taylor and Maclaurin Polynomials

Worked Answer Key

Build each requested polynomial from exact derivative coefficients. Show the center and keep factorial coefficients exact.

1. Find the Taylor polynomial through order 5 for $f(x)=\ln(x)$ centered at $a = 1$.

$$P_5(x) = (x - 1) - \frac{1}{2}(x - 1)^2 + \frac{1}{3}(x - 1)^3 - \frac{1}{4}(x - 1)^4 + \frac{1}{5}(x - 1)^5.$$

1. Use $P_n(x) = \sum_{k=0}^n \frac{f^{(k)}(a)(x-a)^k}{k!}$.
2. Exact nonzero coefficients $f^{(k)}(a)/k!$: $a_1=1$, $a_2=-1/2$, $a_3=1/3$, $a_4=-1/4$, $a_5=1/5$.
3. Substitute $a = 1$ and retain all terms through order 5; a zero coefficient may leave the displayed degree below 5.

Taylor and Maclaurin Polynomials

Worked Answer Key

Build each requested polynomial from exact derivative coefficients. Show the center and keep factorial coefficients exact.

2. Find the Taylor polynomial through order 5 for $f(x)=\sin(x)$ centered at $a = 0$.

$$P_5(x) = x - (1/6)x^3 + (1/120)x^5.$$

1. Use $P_n(x) = \sum_{k=0}^n \frac{f^{(k)}(a)(x-a)^k}{k!}$.
2. Exact nonzero coefficients $f^{(k)}(a)/k!$: $a_1=1$, $a_3=-1/6$, $a_5=1/120$.
3. Substitute $a = 0$ and retain all terms through order 5; a zero coefficient may leave the displayed degree below 5.

Taylor and Maclaurin Polynomials

Worked Answer Key

Build each requested polynomial from exact derivative coefficients. Show the center and keep factorial coefficients exact.

3. Find the Taylor polynomial through order 5 for $f(x)=1/x$ centered at $a = 1$.

$$P_5(x) = 1 - (x - 1) + (x - 1)^2 - (x - 1)^3 + (x - 1)^4 - (x - 1)^5.$$

1. Use $P_n(x) = \sum_{k=0}^n \frac{f^{(k)}(a)}{k!} (x-a)^k$.
2. Exact nonzero coefficients $f^{(k)}(a)/k!$: $a_0=1$, $a_1=-1$, $a_2=1$, $a_3=-1$, $a_4=1$, $a_5=-1$.
3. Substitute $a = 1$ and retain all terms through order 5; a zero coefficient may leave the displayed degree below 5.

Taylor and Maclaurin Polynomials

Worked Answer Key

Build each requested polynomial from exact derivative coefficients. Show the center and keep factorial coefficients exact.

4. Find the Taylor polynomial through order 5 for $f(x)=e^x$ centered at $a = 0$.

$$P_5(x) = 1 + x + \frac{1}{2}x^2 + \frac{1}{6}x^3 + \frac{1}{24}x^4 + \frac{1}{120}x^5.$$

1. Use $P_n(x) = \sum_{k=0}^n \frac{f^{(k)}(a)(x-a)^k}{k!}$.
2. Exact nonzero coefficients $f^{(k)}(a)/k!$: $a_0=1$, $a_1=1$, $a_2=1/2$, $a_3=1/6$, $a_4=1/24$, $a_5=1/120$.
3. Substitute $a = 0$ and retain all terms through order 5; a zero coefficient may leave the displayed degree below 5.

Taylor and Maclaurin Polynomials

Worked Answer Key

Build each requested polynomial from exact derivative coefficients. Show the center and keep factorial coefficients exact.

5. Find the Taylor polynomial through order 4 for $f(x)=\cos(x)$ centered at $a = 0$.

$$P_4(x) = 1 - (1/2)x^2 + (1/24)x^4.$$

1. Use $P_n(x) = \sum_{k=0}^n \frac{f^{(k)}(a)(x-a)^k}{k!}$.
2. Exact nonzero coefficients $f^{(k)}(a)/k!$: $a_0=1$, $a_2=-1/2$, $a_4=1/24$.
3. Substitute $a = 0$ and retain all terms through order 4; a zero coefficient may leave the displayed degree below 4.

Taylor and Maclaurin Polynomials

Worked Answer Key

Build each requested polynomial from exact derivative coefficients. Show the center and keep factorial coefficients exact.

6. Find the Taylor polynomial through order 4 for $f(x)=e^x$ centered at $a = 1$.

$$P_4(x) = e + (e)(x - 1) + (e/2)(x - 1)^2 + (e/6)(x - 1)^3 + (e/24)(x - 1)^4.$$

1. Use $P_n(x) = \sum_{k=0}^n f^{(k)}(a)(x-a)^k/k!$.
2. Exact nonzero coefficients $f^{(k)}(a)/k!$: $a_0=e$, $a_1=e$, $a_2=e/2$, $a_3=e/6$, $a_4=e/24$.
3. Substitute $a = 1$ and retain all terms through order 4; a zero coefficient may leave the displayed degree below 4.