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Hand in Hw # 13

Spring 2013

PROBLEM 15: For what values of x can $\sin x$ be approximated by $x - \frac{x^3}{3!}$ with an error strictly less than $\frac{1}{10}$?

(a) $-\sqrt[7]{12} < x < \sqrt[7]{12}$ (b) $-1 < x < 1$ (c) $-\sqrt[5]{10} < x < \sqrt[5]{10}$

(d) $-2 < x < 2$ (e) $-\sqrt[5]{12} < x < \sqrt[5]{12}$ (f) $-\sqrt[5]{13} < x < \sqrt[5]{13}$

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13. Which of the following numbers is closest to $\sin(18°)$?

(a) $\frac{316}{1000}$ (b) $\frac{313}{1000}$ (c) $\frac{31}{100}$ (d) $\frac{307}{1000}$ (e) $\frac{304}{1000}$ (f) $\frac{301}{1000}$

[**Hint:** $18°$ in radias is $\frac{\pi}{10}$, etc...]

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14. What is the coefficient of x^3 in the Maclaurin series of the function $f(x) = \dfrac{\sin x}{e^x}$?

(a) $-\frac{1}{3}$ (b) $\frac{1}{2}$ (c) $\frac{1}{6}$ (d) $\frac{2}{3}$ (e) $\frac{1}{3}$ (f) $\frac{5}{6}$

[**Hint:** $\dfrac{1}{e^x} = e^{-x}$ and so on...]

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4. Which of the following is an approximation to $\sin(2)$ with error less than $\frac{1}{10}$?

Hint: Use an appropriate series centered at 0.

A) 2 B) $\frac{3}{2}$ C) 1 D) $\frac{14}{15}$ E) $\frac{2}{3}$ F) $\frac{-23}{45}$

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7. Let $f(x) = e^{-x^2}$. Then $f^{(10)}(0)$ is

(A) $-\frac{1}{120}$ (B) $\frac{1}{10!}$ (C) $\frac{10}{5!}$ (D) $-\frac{10!}{5!}$ (E) $\frac{3}{10}$ (F) $\frac{1}{100}$ (G) 1 (H) 0

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9. Which of the following is the best approximation of $\ln(\frac{11}{10})$?

(A) 0 (B) $\frac{1}{10}$ (C) $\frac{5}{100}$ (D) $\frac{9}{100}$ (E) $\frac{95}{1000}$ (F) $\frac{99}{1000}$ (G) $\frac{109}{1000}$ (H) $\frac{155}{1000}$

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10. Consider the function $f(x) = \frac{1}{x}\, e^{-x^2} \sin 2x$ for $x \neq 0$ and $f(0) = 2$. The order three Taylor polynomial $a_0 + a_1 x + a_2 x^2 + a_3 x^3$ of $f(x)$ about $x = 0$ is:

(A) $2 - \frac{10}{3}x^2$ (B) $2x - \frac{4}{3}x^3$ (C) $2 - \frac{4}{3}x^2$ (D) $2 - x^2$

(E) $x - \frac{1}{3}x^3$ (F) $1 + x - x^3$ (G) $-2 + x + \frac{10}{3}x^2$ (H) $2 - x + x^2$

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18. Find the coefficient of x^{10} in the Maclaurin series expansion of $f(x) = 4 - x\sin(x^3)$.
(a) 0 (b) 4 (c) 10 (d) 1/6 (e) 1/10 (f) 1/10!

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13. Compute the Maclaurin series (i.e., the Taylor series about 0) of

$$f(x) = x^2 + \arcsin(x) = \sum_{n=0}^{\infty} a_n x^n = a_0 + a_1 x + a_2 x^2 + \cdots$$

up to and including terms of order two. Then: evaluate $a_0^2 + a_1^2 + a_2^2$.

(Hint: $\dfrac{d}{dx}\arcsin(x) = \dfrac{1}{\sqrt{1-x^2}}$.)

(A) 0 (B) 1 (C) 2 (D) $\dfrac{9}{4}$ (E) 3 (F) $\dfrac{13}{4}$ (G) 4 (H) 5

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20. Consider the polynomial $1 + x + \frac{x^2}{2!} + \frac{x^3}{3!}$ as an approximation to e^x on the interval $-2 \leq x \leq 2$. What is the best bound on the error for this estimate that is given by Taylor's inequality?

(a) $1/24$ (b) $e/12$ (c) $2e^2/3$ (d) $e^3/4$ (e) $3e^4/2$ (f) e^5

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ANSWERS:

Spring 2013 # 15: E

Fall 2012 # 13: C

Fall 2012 # 14: E

Spring 2012 # 4: D

Fall 2011 # 7: D

Fall 2011 # 9: E

Fall 2011 # 10: A

Spring 2011 # 18: D

Fall 2010 # 13: C

Spring 2010 # 20: C