Chain Rule Handout

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Pat Rossi Name _____

Instructions.

For Exercises 1-4 use the facts that

$\frac{d}{dx}[\sin x] = \cos x$, $\frac{d}{dx}[\cos x] = -\sin x$

ANSWERS appear on page 2.

1. $\frac{d}{dx}\left[\sin\left(x^2+3x-7\right)\right] =$
2. $\frac{d}{dx}[\sin(\cos x)] =$
3. $\frac{d}{dx}\left[\cos\left(4x^3\right)\right] =$
4. $\frac{d}{dx}\left[\sin\left(\frac{x^2+1}{2x+3}\right)\right] =$

For exercises 5-7 $P(x)$ is a function that has the property that $P'(x) = \frac{1}{x}$

Compute:

5. $\frac{d}{dx}\left[P\left(3x^4+7x^2+10\right)\right] =$
6. $\frac{d}{dx}\left[P\left(\frac{3x^3+2x}{4x-7}\right)\right] =$
7. $\frac{d}{dx}[P(P(x))] =$

In Problems 8-10 , $E(x)$ is a function that has the property that $E'(x) = E(x)$. Compute:

8. $\frac{d}{dx}\left[E\left(4x^9-7x^3\right)\right] =$
9. $\frac{d}{dx}\left[E\left[\left(x^4+3x\right)^2\right]\right] =$
10. $\frac{d}{dx}[E(E(x))] =$

Answers

(a)

1. $[\cos(x^2+3x-7)]\cdot[2x+3]$
2. $[\cos(\cos x)]\cdot[-\sin x]$
3. $[-\sin(4x^3)]\cdot[12x^2]$
4. $\left[\cos\left(\frac{x^2+1}{2x+3}\right)\right]\cdot\left[\frac{(2x)(2x+3)-(2)\left(x^2+1\right)}{(2x+3)^2}\right]$
5. $\frac{12x^3+14x}{3x^4+7x^2+10}$
6. $\frac{4x-7}{3x^3+2x}\cdot\frac{\left(9x^2+2\right)(4x-7)-4\left(3x^3+2x\right)}{(4x-7)^2}=\frac{\left(9x^2+2\right)(4x-7)-\left(12x^3+8x\right)}{(3x^3+2x)(4x-7)}$
7. $\frac{1}{x\cdot P(x)}$
8. $[E(4x^9+7x^3)]\cdot(36x^8-21x^2)$
9. $\left(E\left[(x^4+3x)^2\right]\right)\cdot 2(x^4+3x)(4x^3+3)$
10. $E[E(x)]\cdot E(x)$