

MTH232

Introduction to the Symbolic Math Toolbox

Project 1– Exercises

NAME: _____
SECTION: _____
INSTRUCTOR: _____

Exercise 1:

Find the zeros of $f(x) = x^3 - x^2 - 18$ symbolically.

- First, what MATLAB command defines x to be a symbolic variable?

(1) Answer:

- What command defines $f(x)$ symbolically?

(2) Answer:

- What command symbolically determines the zeros of $f(x)$?

(3) Answer:

- How many real roots are there?
(4) Circle one: 1. 1 2. 2 3. 3 4. 4
- What are the zero(s) of $f(x)$?
(5) Circle one: 1. 3 and $-1 \pm \sqrt{5}$
2. $-1 \pm \sqrt{5}$
3. 3
4. $2 \pm \sqrt{2}$
- What command verifies your results, that is, evaluates $f(a)$ where a is one of the roots?
(6) Answer:

Exercise 2:

The *linear approximation*, $P_1(x)$, of a function $f(x)$ is defined as

$$P_1(x) = f(a) + f'(a)(x - a)$$

Further, the *quadratic approximation* is defined as

$$P_2(x) = f(a) + f'(a)(x - a) + 1/2 f''(a)(x - a)^2$$

Use symbolic math to find $P_1(x)$ and $P_2(x)$ if $f(x) = \arcsin x$ and $a = 1/2$ (note: $\arcsin x$ in MATLAB is `asin(x)`)

For the following: use fractions, not decimal notation, for constants.

- Assume `syms x` has been entered.
- What MATLAB command defines $f(x) = \arcsin x$ symbolically?
(7) Answer:

- What MATLAB command finds $f'(x)$, and assigns it to a variable called `fp`?
(8) **Answer:**

- What command evaluates $f(1/2)$ symbolically, and assigns it to a variable named `f1`?
(9) **Answer:**

- What command evaluates $f'(1/2)$ symbolically, and assigns it to a variable named `fp1`?
(10) **Circle one:** 1. `fp1=simplify(fp,x,'1/2')`
2. `fp1=solve(fp,x,'1/2')`
3. `fp1=subs(fp,x,'1/2')`
4. `subs(fp,x,'1/2')`

- With all the above commands typed in ,what command would you now use to define $P_1(x)$ in MATLAB, call it `p1`?
(11) **Circle one:** 1. `p1=fp1*(x-1/2)`
2. `p1=f1+fp1*(x-1/2)`
3. `p1=f1+fp1*x-1/2`
4. `p1=f1+fp1*(x-1/2)`

- $P_1(x)$, when *simplified*, is equal to...
(12) Circle one: 1. $1/6 \pi + \sqrt{3}(2/3x - 1/3)$
2. $\pi + \sqrt{2}(2/3x - 1/3)$
3. $1/6 \pi + \sqrt{2}(2/3x - 1/3)$
4. $\sqrt{3}(2/3x - 1/3)$

- What command defines fpp as the second derivative of $f(x)$? (Hint: take the derivative of fp)
(13) Answer:

- What command evaluates $f''(1/2)$ symbolically, and assigns it to a variable named fpp1?
(14) Circle one: 1. `fpp1=simplify(fpp,x,'1/2')`
2. `fpp1=solve(fpp,x,'1/2')`
3. `fpp1=subs(fpp,x,'1/2')`
4. `subs(fpp,x,'1/2')`

- What command would you use to define $P_2(x)$ in MATLAB, call it p2?
(15) Circle one: 1. `p2=f1+fp1*(x-1/2)`
2. `p2=f1+fp1*(x-1/2)+1/2*fpp1*(x-1/2)^2`
3. `p2=f1+fp1*(x-1/2)^2+1/2*fpp1*(x-1/2)`
4. `p2=1/2*fpp1*(x-1/2)^2`

- $P_2(x)$, when *simplified*, is equal to....
(16) Circle one: 1. $1/6 \pi - 5/18 \sqrt{3} + 2/9 \sqrt{3}x^2$
2. $1/6 \pi + 4/9 \sqrt{3}x - 5/18 \sqrt{3} + 2/9 \sqrt{3}x^2$
3. $1/6 \pi + 4/9 \sqrt{3}x + 2/9 \sqrt{3}x^2$
4. $2/9 \sqrt{3}x^2 - 5/18 \sqrt{3}$