Standard Response Questions. Show all your work to receive credit. Please $\boxed{\textbf{BOX}}$ your final answer.

#1. (6 pts) Find the most general antiderivative of $f(x) = x^5 - \sec(c)\tan(x) + \frac{1}{2\sqrt{x}}$.

Solution:

$$\frac{1}{6}x^6 - \sec x + \sqrt{x} + C$$

#2. (8 pts) Determine the value(s) of a such that

$$\int_a^{a+1} (2x+3)\,\mathrm{d}x = 10$$

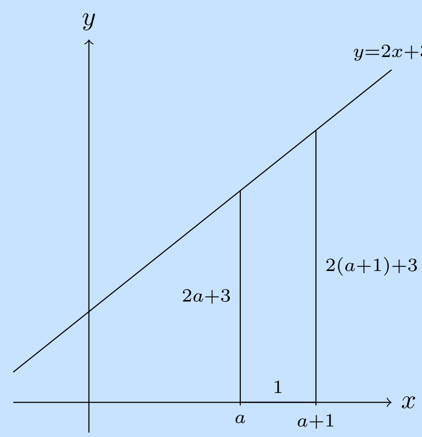
Solution:

The definite integral is the area of the region between $y = 0$ and $y = 2x+3$ from $x = a$ to $x = a+1$. This area is a trapezoid of height 1 and bases $2a+3$ and $2(a+1)+3$ and so has area

$$\frac{\big(2a+1\big) + \big(2(a+1)+3\big)}{2} \cdot 1 = \frac{4a+8}{2} = 2a+4$$

So $\int_a^{a+1}(2x+3)\,\mathrm{d}x = 2a+4$ and we need to find a number a such that

$$2a + 4 = 10$$
$$2a = 6$$
$$\boxed{a = 3}$$

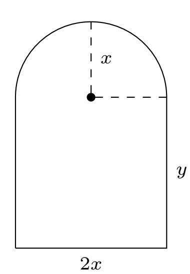


Remark: We could also have calculated the definite integral using the Fundamental Theorem of Calculus:

$$\begin{aligned}\int_a^{a+1}(2x+3)\,\mathrm{d}x &= \big[x^2+3x\big]_a^{a+1} \\ &= \big((a+1)^2 + 3(a+1)\big) - \big(a^2+3a\big) \\ &= \cancel{a^2} + 2a + 1 + \cancel{3a} + 3 - \cancel{a^2} - \cancel{3a} \\ &= 2a+4\end{aligned}$$

#3. (14 pts)

A small region has the shape of a rectangle attached to a semicircle, so that the diameter of the semicircle is equal to the width of the rectangle. The perimeter is $2\,\mathrm{m}$.
What is the width of such a region which has the largest possible area?
What is the largest possible area?
Use one of the techniques of MTH 132 to justify that your solution indeed maximizes the area.



Solution: The area of the rectangle is $2xy$ and the area of the semicircle is $\frac{1}{2}\pi x^2$. So the total area is

$$A = 2xy + \frac{\pi}{2}x^2.$$

The perimeter consists of the bottom (of length $2x$), the two sides (each of length y) and the semicircle (of perimeter $\frac{1}{2} \cdot 2\pi x$). Hence the total perimeter is

$$P = 2x + 2y + \pi x$$

We know that $P = 2$, so

$$\begin{aligned} 2 &= 2x + 2y + \pi x \\ 2y &= 2 - 2x + \pi x \\ y &= 1 - x - \frac{\pi}{2}x \end{aligned}$$

Substituting in the formula for A gives

$$\begin{aligned} A &= 2x\left(1 - x - \frac{\pi}{2}x\right) + \frac{\pi}{2}x^2 \\ &= 2x - 2x^2 - \pi x^2 + \frac{\pi}{2}x^2 \\ &= 2x - 2x^2 - \frac{\pi}{2}x^2 \end{aligned}$$

Thus

$$\begin{aligned} A' &= 2 - 4x - \pi x \\ &= 2 - (4+\pi)x \\ &= (4+\pi)\left(\frac{2}{4+\pi} - x\right) \end{aligned}$$

It follows that $A' = 0$ for $x = \frac{2}{4+\pi}$. Moreover

$$A' > 0 \text{ for } x < \frac{2}{4+\pi} \quad \text{and} \quad A' < 0 \text{ for } x > \frac{2}{4+\pi}.$$

Thus the First Derivative Test for Absolute Extrema shows that A has an absolute maximum at $x = \frac{2}{4+\pi}$. The width of the region with maximal area is

$$2x = 2\frac{2}{4+\pi} = \boxed{\frac{4}{4+\pi}\text{ m}}.$$

and the maximal area is

$$
\begin{aligned}
A &= 2x - 2x^2 - \frac{\pi}{2}x^2 \\
&= \boxed{2\frac{2}{4+\pi} - 2\left(\frac{2}{4+\pi}\right)^2 - \frac{\pi}{2}\left(\frac{2}{4+\pi}\right)^2} \\
&= \frac{4}{4+\pi} - \frac{8}{(4+\pi)^2} - \frac{2\pi}{(4+\pi)^2} \\
&= \frac{(16+4\pi) - 8 - 2\pi}{(4+\pi)^2} \\
&= \frac{8+2\pi}{(4+\pi)^2} \\
&= \frac{2\cancel{(4+\pi)}}{(4+\pi)^{\cancel{2}}} \\
&= \boxed{\frac{2}{4+\pi}\ \mathrm{m}^2}
\end{aligned}
$$

#4. (7 pts) Given $f(x) = 5x^{2/3} - 2x^{5/3}$

(a) (4 pts) Determine all its critical points.

Solution:

$$
\begin{aligned}
f'(x) &= \left(5x^{2/3} - 2x^{5/3}\right)' \\
&= \frac{2}{3}\cdot 5x^{-1/3} - \frac{5}{3}\cdot 2x^{2/3} \\
&= \frac{10}{3}\left(x^{-1/3} - x^{2/3}\right) \\
&= \frac{10}{3}\frac{1}{x^{1/3}} - x^{2/3} \\
&= \frac{10}{3}\frac{1 - x^{1/3}x^{2/3}}{x^{1/3}} \\
&= \frac{10}{3}\frac{1-x}{x^{1/3}}
\end{aligned}
$$

Thus $f' = 0$ at $x = 1$ and $f'(x)$ is not defined at $x = 0$. Note that both $x = 0$ and $x = 1$ are in the domain of f, thus the critical numbers are

$$\boxed{x = 0} \qquad \text{and} \qquad \boxed{x = 1}$$

(b) (4 pts) Classify the critical points as local minima/maxima/neither.

Solution:

	$(-\infty, 0)$	$(0, 1)$	$(1, \infty)$
$1 - x$	$+$	$+$	$-$
$x^{1/3}$	$-$	$+$	$+$
f'	$-$	$+$	$-$
f	$\searrow$	$\nearrow$	$\searrow$

Thus f has a $\boxed{\text{local minimum at } x = 0}$ and a $\boxed{\text{local maximum at } x = 1}$

#5. (7 pts) Determine the absolute extrema of the function $f(x) = x - 2\sin x$ on the interval $[0, \pi]$. ($\sqrt{3} \approx 1.73$)

Solution: Note that $f(x)$ is continuous, so we can use the Continuous Closed Interval Method.

$$f'(x) = (x - 2\sin x)' = 1 - 2\cos x$$

Hence f' is defined for all x and

$$\begin{aligned} f'(x) &= 0 \\ 1 - 2\cos x &= 0 \\ 2\cos x &= 1 \\ \cos x &= \frac{1}{2} \end{aligned}$$

In the interval $[0, \pi]$ the only solution of $\cos x = \frac{1}{2}$ is $x = \frac{\pi}{3}$. Thus $\frac{\pi}{3}$ is the only critical number. Next we compute the values of f at the endpoints and the critical points:

$$\begin{aligned} f(0) &= 0 - 2\sin(0) = 0 - 2 \cdot 0 && = 0 \\ f\left(\frac{\pi}{3}\right) &= \frac{\pi}{3} - 2\sin\frac{\pi}{3} = \frac{\pi}{3} - \cancel{2}\frac{\sqrt{3}}{\cancel{2}} < \frac{3.3}{3} - 1.7 = 1.1 - 1.7 = -0.6 && < 0 \\ f(\pi) &= \pi - 2\sin\pi = \pi - 2 \cdot 0 = \pi && > 0 \end{aligned}$$

The largest of these values is π, and the smallest is $\frac{\pi}{3} - \sqrt{3}$. Thus the absolute maximum value of f on $[0, \pi]$ is $\boxed{\pi}$, attained at $x = \pi$, and the absolute minimum value of f on $[0, \pi]$ is $\boxed{\frac{\pi}{3} - \sqrt{3}}$, attained at $x = \frac{\pi}{3}$.

#6. (6 pts) Compute $\lim_{x \to \infty} \left(\sqrt{4x^2 + 3x} - 2x\right)$.

Solution: We first compute

$$\begin{aligned} \sqrt{4x^2 + 3x} - 2x &= \frac{\sqrt{4x^2 + 3x} - 2x}{1} \frac{\sqrt{4x^2 + 3x} + 2x}{\sqrt{4x^2 + 3x} + 2x} &&= \frac{\sqrt{4x^2 + 3x}^2 - (2x)^2}{\sqrt{4x^2 + 3x} - 2x} \\ &= \frac{\cancel{4x^2} + 3x - \cancel{4x^2}}{\sqrt{4x^2 + 3x} + 2x} &&= \frac{3x}{\sqrt{x^2\left(4 + \frac{3}{x}\right)} + 2x} \\ &= \frac{3x}{x\sqrt{4 + \frac{3}{x}} + 2x} &&= \frac{3\cancel{x}}{\cancel{x}\left(\sqrt{4 + \frac{3}{x}} + 2\right)} \\ &= \frac{3}{\sqrt{4 + \frac{3}{x}} + 2} \end{aligned}$$

and so

$$\lim_{x\to\infty} \sqrt{4x^2+3x} - 2x = \lim_{x\to\infty} \frac{3}{\sqrt{4+\frac{3}{x}}+2} = \frac{3}{\sqrt{4+0}+2} = \frac{3}{2+2} = \boxed{\frac{3}{4}}$$

#7. (8 pts) The acceleration of an object moving along the x-axis is $a(t) = 3\sin t$. What are its velocity and position functions, $v(t)$ and $s(t)$, if $v(0) = 1$ and $s(0) = 3$?

Solution: Recall that $a = v'$, so v is an antiderivative of $3\sin t$. Thus

$$v = -3\cos t + C,$$

C a constant. This gives

$$1 = v(0) = -3\cos 0 + C = -3\cdot 1 + C = C - 3$$

and so $C = 1 + 3 = 4$. Hence

$$\boxed{v = -\cos t + 4}$$

and since $s' = v$,

$$s = -3\sin t + 4t + D,$$

D a constant. So

$$3 = s(0) = -3\sin 0 + 4\cdot 0 = -0 + 0 + D = D$$

and

$$s = \boxed{-3\sin t + 4t + 3}.$$

Multiple Choice. Circle the best answer. No work needed.
No partial credit available.

#8. (4 pts) Determine all values of c satisfying the Mean Value Theorem for the function $f(x) = x^3 - 4x$ on the interval $-1 \leq x \leq 3$.

$\boxed{\text{A.}\quad \left(\frac{7}{3}\right)^{1/2}}$ B. $\pm\sqrt{\frac{7}{3}}$ C. 5 D. 3

Solution 1: Recall that the number c in the Mean Value Theorem lies in the open interval $(-1, 3)$. Note that $1 < \frac{7}{3} < 4$ and so $1 < \sqrt{\frac{7}{3}} < 2$ and $-\sqrt{\frac{7}{3}} < -1$. So of the given possible answers only $\sqrt{\frac{7}{3}}$ (which is equal to $\left(\frac{7}{3}\right)^{1/2}$) lies in $(-1, 3)$. Hence A. is the only possible correct answer.

Solution 2: According to the Mean Value Theorem, c is in (a, b) and

$$f'(c) = \frac{f(b) - f(a)}{b - a}$$

We have $a=-1$, $b=3$,

$$
\begin{aligned}
f(x) &= x^3-4x \\
f'(x) &= 3x^2-4 \\
f(3) &= 3^3-4\cdot 3 = 27-12 = 15 \\
f(-1) &= (-1)^3-4\cdot(-1) = -1+4 = 3
\end{aligned}
$$

$$
\begin{aligned}
3c^2-4 = f'(c) &= \frac{f(3)-f(-1)}{3-(-1)} = \frac{15-3}{4} = \frac{12}{4} = 3 \\
3c^2 &= 3+4 = 7 \\
c^2 &= \frac{7}{3} \\
c &= \pm\sqrt{\frac{7}{3}}
\end{aligned}
$$

Of $\sqrt{\frac{7}{3}}$ and $-\sqrt{\frac{7}{3}}$ only $\sqrt{\frac{7}{3}}$ lies in the interval $(-1,3)$. So $c=\sqrt{\frac{7}{3}}=\left(\frac{7}{3}\right)^{1/2}$ and A. is the correct answer.

#9. (4 pts) If the length of a side of a cube is measured to be 5 cm with a maximum error of 0.1 cm, use differentials to estimate the maximum error in the surface area.

$\boxed{\text{A. } 6\,\mathrm{cm}^2}$ B. $11.2\,\mathrm{cm}^2$ C. $3\,\mathrm{cm}^2$ D. $60\,\mathrm{cm}^2$ E. $6\,\mathrm{cm}$

Solution: Let x be the length of the side of the cube and S the surface area. The surface area consists of six squares of height x. So $S=6x^2$. Thus

$$
\mathrm{d}S = \frac{\mathrm{d}S}{\mathrm{d}x}\,\mathrm{d}x = \frac{\mathrm{d}6x^2}{\mathrm{d}x}\,\mathrm{d}x = 12x\,\mathrm{d}x
$$

For $x=5$ and $\mathrm{d}x=\Delta x=0.1$ we get

$$
\mathrm{d}S = 12\cdot 5\cdot 0.1 = 60\cdot 0.1 = 6\,\mathrm{cm}^2
$$

Thus A. is the correct answer.

#10. (4 pts) Compute $\lim_{n\to\infty}\sum_{i=1}^{\infty}\frac{2i}{n^2}$.

A. 0 $\boxed{\text{B. } 1}$ C. 2 D. DNE

Solution 1:

$$
\begin{aligned}
\sum_{i=1}^{\infty}\frac{2i}{n^2} &= \frac{2}{n^2}\sum_{i=1}^{n} i \\
&= \frac{\cancel{2}}{n^{\cancel{2}}}\,\frac{\cancel{n}(n-1)}{\cancel{2}} \\
&= \frac{n-1}{n} \\
&= 1-\frac{1}{n}
\end{aligned}
$$

and so

$$\lim_{n\to\infty}\sum_{i=1}^{\infty}\frac{2i}{n^2}=\lim_{n\to\infty}\left(1-\frac{1}{n}\right)=1-0=1$$

So B. is the correct answer.

Solution 2: We will write the limit as a limit of right hand sums $R_n=\sum_{i=1}^{n} f(x_i)\Delta x$. Recall that $x_i=a+i\Delta x$ and $\Delta x=\frac{b-a}{n}$. So we want to find f, Δx, a and b such that

$$\begin{aligned}
&f(a+i\Delta x)\Delta x\\
=&\frac{2i}{n^2}\\
=&2i\frac{1}{n}\frac{1}{n}
\end{aligned}$$

So we can choose $f(x)=2x$, $a=0$ and $\Delta x=\frac{1}{n}$. Then

$$b=a+n\Delta x=0+n\frac{1}{n}=1$$

Thus

$$\begin{aligned}
\lim_{n\to\infty}\sum_{i=1}^{\infty}\frac{2i}{n^2}&=\lim_{x\to\infty}\sum_{i=1}^{n}f(x_i)\Delta x\\
&=\int_a^b f(x)\,\mathrm{d}x\\
&=\int_0^1 2x\,\mathrm{d}x\\
&=\left[x^2\right]_0^1\\
&=1^2-0^2\\
&=1
\end{aligned}$$

Hence B. is the correct answer.

#11. (4 pts) Which function should you apply Newton's method to, in order to estimate $\sqrt{5}$?

A. x^2-25 B. $\sqrt{5}-x^2$ C. $x-5$ $\boxed{\text{D. } x^2-5}$

Solution: We need a function f with $f(\sqrt{5})=0$. This holds for $f=x^2-5$. So D. is a correct answer. To make sure that none of the others work:

$$\begin{aligned}
(\sqrt{5})^2-25&=5-25\neq 0\\
\sqrt{5}-(\sqrt{5})^2&=\sqrt{5}-5\neq 0\\
\sqrt{5}-5&\neq 0
\end{aligned}$$

So D. is indeed the only correct answer.

#12. (4 pts) The derivative of $f(x) = \displaystyle\int_1^{2x^2} \frac{\sin t}{1+t^2}\,\mathrm{d}t$ is

A. $\frac{\sin x}{1+x^2}$ | $\boxed{\text{B. } \frac{\sin(2x^2)}{1+4x^4}}$ | C. $\frac{4x \sin x}{1+x^2}$ | D. $\frac{4x\sin(x^2)}{1+4x^4}$

Solution: Let

$$g(x) = \frac{\sin x}{1+x^2} \quad \text{and} \quad G(x) = \int_1^x g(t)\,\mathrm{d}t = \int_1^x \frac{\sin t}{1+t^2}\,\mathrm{d}t.$$

By the Fundamental Theorem of Calculus $G'(x) = g(x)$. So

$$\begin{aligned}\left(\int_1^{2x^2} \frac{\sin t}{1+t^2}\,\mathrm{d}t\right)' &= \left(G(2x^2)\right)' \\ &= G'(2x^2)(2x^2)' \\ &= g(2x^2)4x \\ &= \frac{\sin(2x^2)}{1+(2x^2)^2}4x \\ &= \frac{4x\sin(2x^2)}{1+4x^4}\end{aligned}$$

Hence D. is the correct answer.

#13. (4 pts) Determine the value of $\int_{-5}^{0} |x+3|\,\mathrm{d}x$. (*Hint: Draw a picture of the region the integral represents, and find the area using simple formulas form geometry.*)

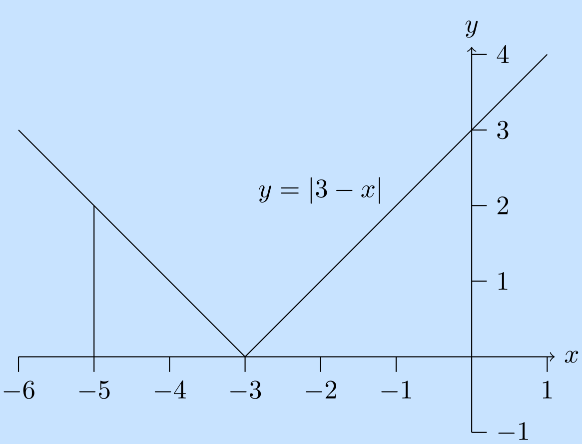
A. -6.5 | B. -5.5 | C. 0.5 | D. 5.5 | $\boxed{\text{E. } 6.5}$

Solution:

The definite integral is the area of the region between $y = 0$ and $y = |x+3|$ from $x = -5$ to $x = 0$. This region consists of two triangles: One of height 2 and base 2 and one of height 3 and base 3. The area of a triangle with height h and base b is $\frac{1}{2}hb$. So

$$\int_{-1}^{5} |x+3|\,\mathrm{d}x = \frac{1}{2}\cdot 2\cdot 2 + \frac{1}{2}\cdot 3\cdot 3 = \frac{4+9}{2} = \frac{13}{2} = 6.5$$

Hence E. is the correct answer.



#14. (4 pts) Using linear approximation, what is the best estimate of $\sqrt{4.1}$?

$\boxed{\text{A. } 2+\frac{1}{40}}$ | B. $2+\frac{1}{20}$ | C. $2+\frac{1}{10}$ | D. 2.

Solution: Let $f(x) = \sqrt{x}$ and $a = 4$. Then

$$
\begin{aligned}
f(4) &= \sqrt{4} = 2 \\
f'(x) &= \frac{1}{2\sqrt{x}} \\
f'(4) &= \frac{1}{2\sqrt{4}} = \frac{1}{2 \cdot 2} = \frac{1}{4} \\
L(x) &= f(a) + f'(a)(x-a) \\
&= 2 + \frac{1}{4}(x-4)
\end{aligned}
$$

and so

$$\sqrt{4.1} \approx L(4.1) = 2 + \frac{1}{4}(4.1 - 4) = 2 + \frac{1}{4} \cdot 0.1 = 2 + \frac{1}{4}\frac{1}{10} = 2 + \frac{1}{40}$$

Hence A. is the correct answer.

#15. (4 pts) Select the true statements about the function $f(x) = \frac{x^3+4x}{(x+2)(x-1)}$:

A. The function has no vertical asymptotes and only one slant asymptote.
B. The function has only one vertical asymptote and only one slant asymptote.
C. The function has only two vertical asymptote and no slant asymptotes.
$\boxed{\text{D. The function has only two vertical asymptote and only one slant asymptote.}}$

Solution: Since $f(x) = \frac{x^3+x}{(x+2)(x-1)} = \frac{x(x^2+1)}{(x+2)(x-1)}$ we see that $x = -2$ and $x = 1$ are the zeros of the denominator of f, but neither -2 nor 1 are zeros of the numerator of f. It follows that

$$\lim_{x \to 2^{\pm}} f(x) = \pm\infty \quad \text{and} \quad \lim_{x \to -1^{\pm}} f(x) = \pm\infty$$

Thus

$$x = 2 \qquad \text{and} \qquad x = -1$$

are the vertical asymptotes of $f(x)$.

Note that $(x-2)(x+1) = x^2 - 2x + x - 2 = x^2 - x - 2$ and

$$
\begin{array}{r|llllll}
 & x & + & 1 & & & \\
\cline{2-7}
x^2 - x - 2 & x^3 & & & + & x & \\
 & x^3 & - & x^2 & - & 2x & \\
\cline{2-7}
 & & & x^2 & + & 3x & \\
 & & & x^2 & - & x & - \; 2 \\
\cline{3-7}
 & & & & & 4x & + \; 2
\end{array}
$$

So

$$f(x) = x + 1 + \frac{4x+2}{x^2 - x - 2} = x + 1 + \frac{x(4 + \frac{2}{x})}{x^2(1 - \frac{1}{x} - \frac{2}{x^2})} = \frac{1 + \frac{2}{x}}{x(1 - \frac{1}{x} - \frac{2}{x^2})}$$

and

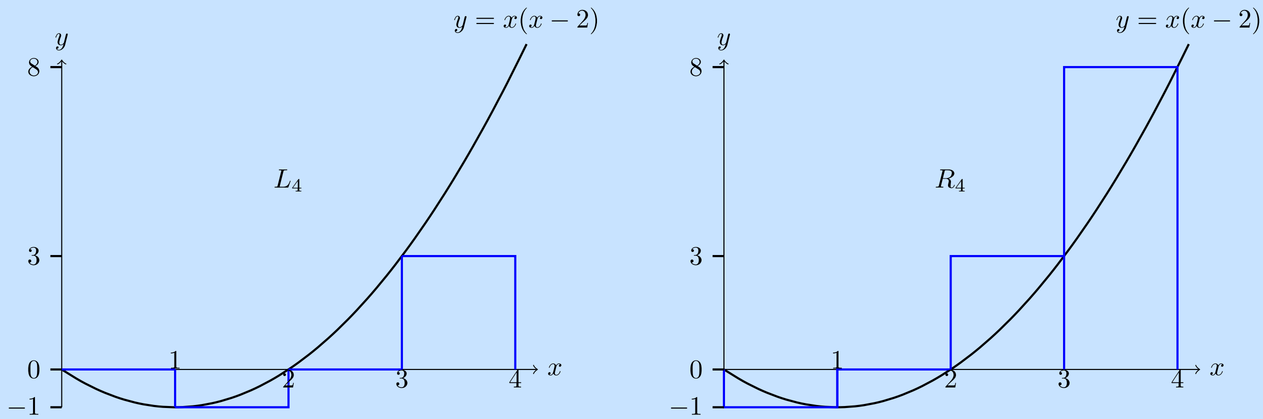
$$\lim_{x \to \pm\infty} f(x) - (x+1) = \lim_{x \to \pm\infty} \frac{1 + \frac{2}{x}}{x(1 - \frac{1}{x} - \frac{2}{x^2})} = 0$$

Thus $x + 1$ is the only slant asymptote of $f(x)$. So D. is the correct answer.

#16. (4 pts) Estimate the area A under the graph $y = x(x-2)$, between $x = 0$ and $x = 4$, using 4 rectangles of equal width, with heights of the rectangles determined by the height of the curve at the left endpoints and the right endpoints.

A. $A = 1$ using left endpoints; $A = 8$ using right endpoints.
B. $A = -1$ using left endpoints; $A = 9$ using right endpoints.
C. $A = 10$ using left endpoints; $A = 2$ using right endpoints.
$\boxed{\text{D. } A = 2 \text{ using left endpoints; } A = 10 \text{ using right endpoints.}}$

Solution:



Each interval has length $\frac{4-0}{4} = 1$. So the partition points are $0, 1, 2, 3, 4$. We compute

x	0	1	2	3	4
$x(x-2)$	0	-1	0	3	8

Thus

$$\begin{aligned} L_4 &= (0 + (-1) + 0 + 3) \cdot 1 = 2 \\ R_4 &= (-1 + 0 + 3 + 8) \cdot 1 \quad = 10 \end{aligned}$$

Thus D. is the correct answer.

More Challenging Question(s)

#17. (14 pts) The function $f(x)$ has *all* of the following properties.

1. $\lim_{x \to 2^-} f(x) = -\infty$
2. $\lim_{x \to 2^+} f(x) = \infty$
3. $f(2)$ DNE.
4. $\lim_{x \to -\infty} f(x) = 0$.
5. $f(-2) = 2$
6. $f(5) = 1$
7. $f(0) = 0$.
8. $f'(x) > 0$ if $x < -2$ or $x > 5$.
9. $f'(x) < 0$ if $-2 < x < 2$ or $2 < x < 5$.
10. $f'(5) = 0$.
11. $f'(-2) = 0$
12. $f''(x) > 0$ if $x < -3$ or $x > 2$.
13. $f''(x) < 0$ if $-3 < x < 2$.

Complete the following sentences:

(a) The domain of the function is: $\boxed{(-\infty,-2)\cup(2,\infty)}$

(b) Such function must have vertical asymptote(s), with equation(s): $\boxed{x=2}$.

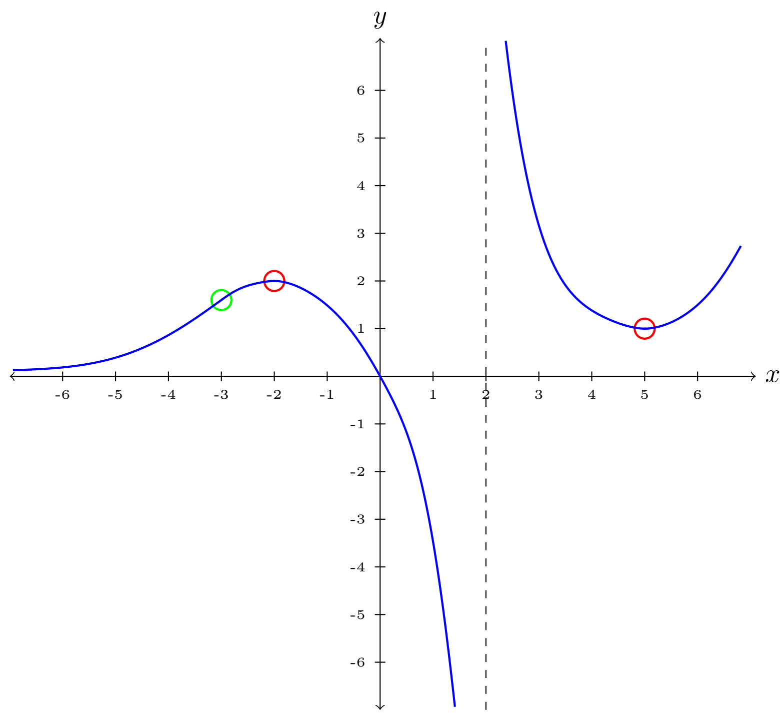
(c) There must be a horizontal asymptote with equation $\boxed{y=0}$.

(d) There must be a local maximum of $\boxed{2 \text{ at } x=-2}$, and a local minimum of $\boxed{1 \text{ at } x=5}$.

(e) Such function must have inflection point(s) at $x=\boxed{-3}$.

(f) The function must be negative on $\boxed{(0,2)}$.

(g) Sketch the curve.



Solution: Since $f(2)$ does not exist, 2 is not in the domain. We know that $f'>0$ for $x<-2$, $f'(-2)=0$, $f'>0$ for $-2<x<2$, $f'(x)<0$ for $2<x<5$, $f'(5)=0$ and $f'(x)>0$ for $5<x$. Thus $f'(x)$ is defined for all $x\neq 2$ and so also f is defined for all $x\neq 2$. Thus the domain of f is $\boxed{(-\infty,2)\cup(2,\infty)}$.

Since $\lim_{x\to 2^{\pm 2}} f(x)=\pm\infty$, we know that $\boxed{x=2 \text{ is a vertical asymptote}}$.

As $\lim_{x\to-\infty} f(x)=0$, we know that $\boxed{y=0 \text{ is a horizontal asymptote.}}$

We have

	$(-\infty,-2)$	$(-2,2)$	$(2,5)$	$(5,\infty)$
f'	$+$	$-$	$-$	$+$
f	$\nearrow$	$\searrow$	$\searrow$	$\nearrow$

Also $f(-2)=2$ and $f(5)=1$. So the first derivative test shows that f has a $\boxed{\text{local maximum value of 2 at } x=-2}$ and a $\boxed{\text{local minimum value of 1 at } x=5}$.

From the information on the second derivative we have

	$(-\infty,-3)$	$(-3,2)$	$(5,\infty)$
f''	$+$	$-$	$+$
f	$\cup$	$\cap$	$\cup$

Hence f changes concavity at $x=-3$ and $x=2$. But f is not defined at $x=2$. So the only $\boxed{\text{inflection point of } f \text{ is at } x=-3}$.

Since $f(0)=0$ and f is decreasing on $(-2,2)$ we see that $\boxed{f \text{ is negative on } (0,2).}$