1. If $y = (x+1)(x+2)^2(x+3)^2$, then $y'(0) =$

$\boxed{\text{(a) } 96}$
(b) 32
(c) 72
(d) 108
(e) 48

$$\ln y = \ln(x+1) + 2\ln(x+2) + 2\ln(x+3)$$

$$\frac{y'}{y} = \frac{1}{x+1} + \frac{2}{x+2} + \frac{2}{x+3}$$

$$y'(0) = y(0)\left(1 + 1 + \frac{2}{3}\right)$$

$$= 36\left(\frac{8}{3}\right)$$

$$= 96$$

@ 23, 12.5

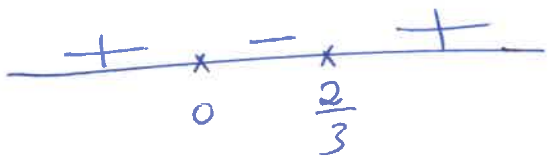
2. The number of inflection points of the function $f(x) = 6x^4 - 8x^3 + 1$ is equal to

$\boxed{\text{(a) } 2}$
(b) 0
(c) 4
(d) 3
(e) 1

$$f'(x) = 24x^3 - 24x^2$$

$$f''(x) = 72x^2 - 48x$$

$$= 24x(3x-2)$$



Example 2, 13.3

Two inflection points

3. If $y = 7x^2 - 6x + 3$, then $\frac{dx}{dy}$ at $x = 1$ is equal to

(a) $\boxed{\frac{1}{8}}$
(b) 8
(c) 4
(d) $\frac{1}{4}$
(e) $\frac{1}{2}$

$\frac{dy}{dx} = 14x - 6 \Rightarrow \frac{dx}{dy} = \frac{1}{14x-6}$

$\left.\frac{dx}{dy}\right|_{x=1} = \frac{1}{8}$.

Q33 , 14.1

4. If $f(x) = e^{x^2}$, then $f''(1) =$

(a) $\boxed{6e}$
(b) $2e$
(c) $4e$
(d) e
(e) $3e$

$f'(x) = 2x\, e^{x^2}$

$f''(x) = 2x\,(2x)\, e^{x^2} + e^{x^2}(2)$

$f''(1) = 4e + 2e = 6e$.

Example 2 , 12.7

5. The function $y = -x^3 + 12x - 3$ is increasing on

(a) $\boxed{(-2, 2)}$
(b) $(-\infty, -2) \cup (2, \infty)$
(c) $(0, \infty)$
(d) $(-\infty, -2)$
(e) $(-1, 1)$

$y' = 12 - 3x^2$

$= 3(4 - x^2)$

$= 3(2-x)(2+x)$

$-$ $+$ $-$

-2 2

increasing on $(-2, 2)$

Q16, 13.1

6. If m is the absolute minimum and M is the absolute maximum of the function $f(x) = -2x^2 - 6x + 5$, $x \in [-3, 2]$, then $m + M =$

(a) $\boxed{-\frac{11}{2}}$
(b) $\frac{11}{2}$
(c) 0
(d) $-\frac{21}{2}$
(e) -10

$f'(x) = -4x - 6$

$f'(x) = 0 \Rightarrow x = -\frac{3}{2}$

x	$f(x)$	
-3	5	
$-\frac{3}{2}$	$\frac{19}{2}$	$\rightarrow M$
2	-15	$\rightarrow m$

$m + M = \frac{-11}{2}$

Q2, 13.2

7. The graph of function $f(x) = x^3 - 6x^2 + 9x$ is concave up on

$\boxed{\text{(a) } (2, \infty)}$

(b) $(-\infty, 2)$

(c) $(-\infty, 1)$

(d) $(1, 2)$

(e) $(0, 2)$

$f'(x) = 3x^2 - 12x + 9$

$f''(x) = 6x - 12$

$= 6(x-2)$

$- - - - - \times + + + + +$

2

Concave up on $(2, \infty)$.

Q42, 13.3

8. The oblique asymptote of the graph of the function $f(x) = \dfrac{10x^2 + 9x + 5}{5x + 2}$, is

$\boxed{\text{(a) } y = 2x + 1}$

(b) $y = x + 1$

(c) $y = 2x$

~~(d)~~ $\cancel{y = 2x + 5}$

(e) $y = -2x + 1$

$$
\begin{array}{r|l}
 & 2x + 1 \\
\hline
5x+2 & \cancel{10x^2} + 9x + 5 \\
 & -\cancel{10x^2} \mp 4x \\
\hline
 & 5x + 5 \\
 & -5x \mp 2 \\
\hline
 & 3
\end{array}
$$

$\Rightarrow$ $y = 2x + 1$ is an oblique asymptote.

Example 3, 13.5

9. The number of vertical asymptotes of the graph of the function

$$f(x) = \frac{2x^3+1}{3x(2x-1)(4x-3)},$$

is

Vertical asymptotes are

$x = 0$, $x = \frac{1}{2}$, $x = \frac{3}{4}$

(a) 3
(b) 2
(c) 0
(d) 1
(e) 4

Q 14 , 13.5:

10. If $y = 1$ is the horizontal asymptote of the graph of the function

$$f(x) = \frac{kx^4+7}{2x(x-1)^2(3x-1)},$$

then $k =$

$\frac{k}{(2)(3)} = 1 \Rightarrow \boxed{k = 6}$

(a) 6
(b) 7
(c) 2
(d) 3
(e) 1

Similar to Q 20 , 13.5

11. The demand equation for a manufacturer's product is

$$p = \frac{80 - q}{4}, \quad 0 \le q \le 80$$

then the maximum revenue occurs at

(a) $\boxed{q = 40}$
(b) $q = 20$
(c) $q = 60$
(d) $q = 50$
(e) $q = 30$

$r = pq = \dfrac{80q - q^2}{4}, \quad q \in [0, 80]$.

$\Rightarrow \dfrac{dr}{dq} = \dfrac{80 - 2q}{2} = 0 \Rightarrow q = 40$

$+ + + + + \times - - - -$

40

Example 2, 13.6

$\Rightarrow q = 40$ gives the abs. max. revenue

q	$r(q)$
0	0
40	400
80	0

12. Let $f(x) = \sqrt[3]{x}$, then by using differentials $f(9) =$

(a) $\boxed{\frac{25}{12}}$
(b) $\frac{1}{12}$
(c) $\frac{23}{12}$
(d) $\frac{49}{12}$
(e) 2

$f(x + dx) \approx f(x) + dy = f(x) + f'(x)\, dx$

$x = 8, \quad dx = 1$

$\boxed{f'(x) = \frac{1}{3} x^{-2/3}}$

$\Rightarrow \sqrt[3]{9} = f(8+1) \approx \sqrt[3]{8} + \dfrac{1}{3(\sqrt[3]{8})^2}(1)$

$= 2 + \dfrac{1}{12} = \dfrac{25}{12}$

Q21, 14.1

13. $\int (x^2+5)(x-3)\,dx =$

$$\int (x^3-3x^2+5x-15)\,dx$$

$$= \frac{x^4}{4} - x^3 + \frac{5x^2}{2} - 15x + c$$

(a) $\frac{x^4}{4} - x^3 + \frac{5x^2}{2} - 15x + c$

(b) $\frac{x^4}{4} + x^3 - \frac{5x^2}{2} + 15x + c$

(c) $\frac{x^4}{4} - x^3 + \frac{x^2}{2} - 15x + c$

(d) $\frac{x^4}{4} - x^3 + \frac{5x^2}{2} - 5x + c$

(e) $-x^3 + \frac{5x^2}{2} - 15x + c$

Q41, 14.2

14. $\int \frac{8\sqrt[5]{x^9} - 4x^3 + x^2e^x}{x^2}\,dx$

$$= \int (8x^{-1/5} - 4x + e^x)\,dx$$

$$= 10x^{4/5} - 2x^2 + e^x + c$$

(a) $10\sqrt[5]{x^4} - 2x^2 + e^x + c$

(b) $10\sqrt[4]{x^5} - 2x^2 + e^x + c$

(c) $8\sqrt[5]{x^4} - 2x^2 + e^x + c$

(d) $10\sqrt[5]{x^4} - x^2 + e^x + c$

(e) $10\sqrt[5]{x^4} - 2x^2 + xe^x + c$

Similar to Ex 6, 14.2

15. If $y' = -x^2 + 2x$ and $y(2) = 1$, then $y(1) =$

(a) $\boxed{\frac{1}{3}}$

(b) $-\frac{1}{3}$

(c) $\frac{2}{3}$

(d) 1

(e) 0

$y = \int (-x^2 + 2x)\, dx = -\frac{x^3}{3} + x^2 + c$

$\Rightarrow y(2) = 1 \Rightarrow c = \frac{-1}{3}$

$\Rightarrow y = -\frac{x^3}{3} + x^2 - \frac{1}{3}$

Q4, 14.3

$\Rightarrow y(1) = \frac{1}{3}$