

## 微積分 演習 (略解) (情報メディア学科 1 年次科目)

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## 5 テイラー展開

### 5.1 お奨め問題

略解

1.  $f^{(n)}(0) = \frac{1}{2}(1 + (-1)^n)$ .
2. 接線  $y = 10(x - 1) + 7$ . 接放物線  $y = 7 + 10(x - 1) + \frac{1}{2} \cdot 12 \cdot (x - 1)^2$ .
3.  $g(x) = -1 + \frac{4}{2!}(x - \frac{1}{2}\pi)^2 + \frac{-16}{4!}(x - \frac{1}{2}\pi)^4$ .

### 5.2 接放物線

次の関数  $f(x)$  の, 指定された点での接放物線を求め,  $y = f(x)$  と接放物線のグラフを描こう (すごく正確でなくてもよい)

略解

1.  $g(x) = \frac{1}{2}x^2 + 1$
2.  $g(x) = 0 + 6(x - \sqrt{3}) + \frac{1}{2} \cdot 6\sqrt{3}(x - \sqrt{3})^2 = 3\sqrt{3}(x - \frac{2}{\sqrt{3}})^2 - \sqrt{3}$ .
3.  $g(x) = 2 + 0 \cdot (x + 1) + \frac{1}{2}(-6)(x + 1)^2 = -3(x + 1)^2 + 2$ .

### 5.3 テイラー展開

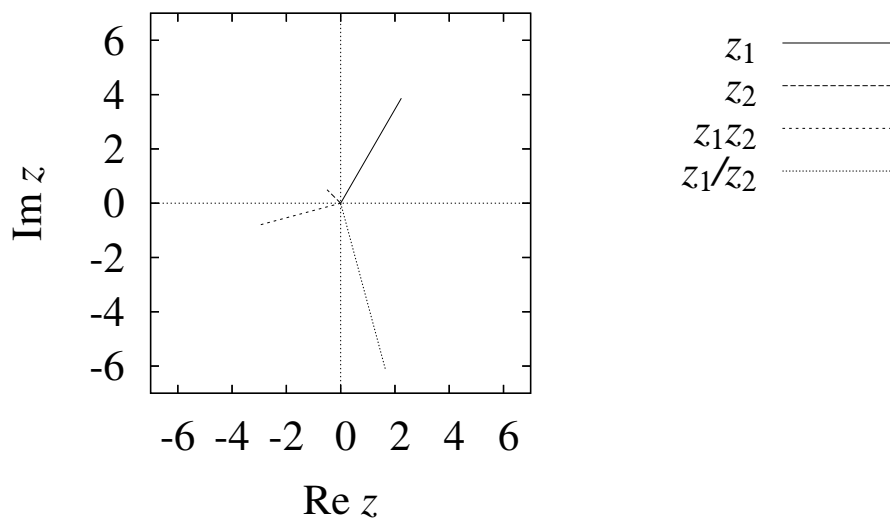
略解

1.  $g(x) = x + \frac{1}{3!}x^3 + \frac{1}{5!}x^5$ .
2.  $g(x) = 1 + \frac{1}{e}(x - e) + \frac{1}{2!} \frac{-1}{e^2}(x - e)^2 + \frac{1}{3!} \frac{2}{e^3}(x - e)^3$ .
3.  $g(x) = -(x - \pi) + \frac{1}{3!}(x - \pi)^3 - \frac{1}{5!}(x - \pi)^5$ .

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5.4 復習問題:極形式での積と商

略解



- 1.
2.  $z_1 = 2\sqrt{5}e^{\frac{1}{3}\pi i}$ ,  $z_2 = \frac{1}{\sqrt{2}}e^{\frac{3}{4}\pi i}$ .
3.  $z_1 z_2 = \sqrt{10}e^{\frac{13}{12}\pi i}$ .
4.  $z_1 / z_2 = 2\sqrt{10}e^{\frac{19}{12}\pi i}$ .

S. 1. 4

$$f(x) = \cosh x$$

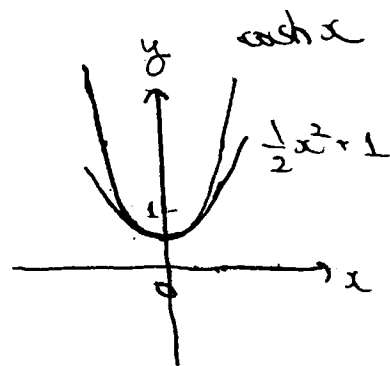
$$f'(x) = \sinh x$$

$$f''(x) = \cosh x$$

$$f(0) = 1$$

$$f'(0) = 0$$

$$f''(0) = 1$$



Taylor polynomial approximation  $g(x) = 1 + 0(x-0) + \frac{1}{2} \cdot 1 \cdot (x-0)^2 = \frac{1}{2}x^2 + 1$

S. 2. 2

$$f(x) = x^3 - 3x$$

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

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

$$f(-1) = 2$$

$$f'(-1) = 0$$

$$f''(-1) = -6$$

$$g(x) = -3(x+1)^2 + 2$$

S. 3. 3

$$f(\sqrt{3}) = 0$$

$$f''(\sqrt{3}) = 6$$

$$f'''(\sqrt{3}) = 6\sqrt{3}$$

$$g(x) = 0 + 6(x-\sqrt{3}) + \frac{1}{2} \cdot 6\sqrt{3}(x-\sqrt{3})^2$$

$$= 3\sqrt{3} \left( x^2 - 2\sqrt{3}x + \frac{2}{\sqrt{3}}x \right) - 6\sqrt{3} + 9\sqrt{3}$$

$$= 3\sqrt{3} \left( x - \frac{2}{\sqrt{3}} \right)^2 - \sqrt{3}$$

