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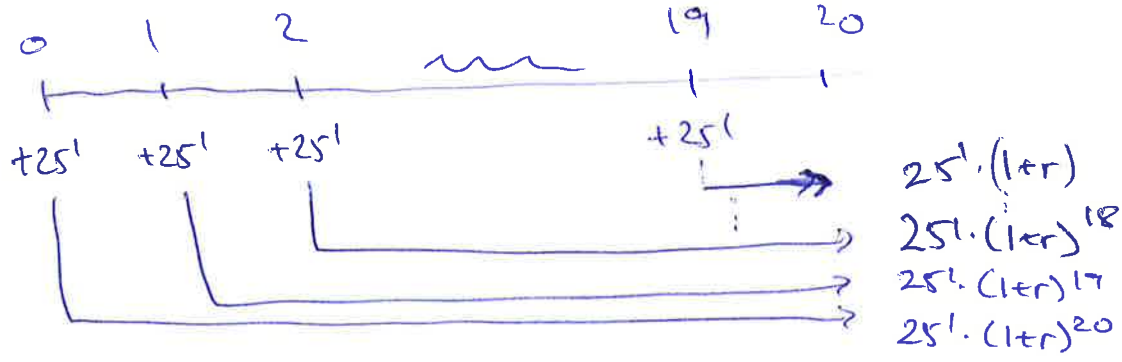
Løsning, prøve-eksamen April/2016 MET1180

1.




Balanse på kto etter 20 år:

$$25000 \cdot 1{,}024 + 25000 \cdot 1{,}024^2 + \dots + 25000 \cdot 1{,}024^{20}$$

$$= 25.000 \cdot 1{,}024 \cdot \frac{1{,}024^{20} - 1}{1{,}024 - 1} \simeq 647.400{,}58$$

Innskudd: $20 \cdot 25.000 = 500.000{,}00$

Således renter: $\underline{\underline{147.400{,}58}}$ C

2. Samme oppsett som i 1:

$$25000 \cdot 1{,}05 \cdot \frac{1{,}05^{20} - 1}{1{,}05 - 1} \simeq 867.981{,}30$$

– Innskudd: 500.000,00

367.981,30 kr D

4. $k = \frac{1+g}{1+r}$ uendelig geometrisk rekke

konvergent for $-1 < \frac{1+g}{1+r} < 1$

$$-(1+r) < 1+g < 1+r$$

konv. for $g = 0{,}05 = 5\%$ $\xrightarrow{\text{ok}}$ $g < r = 8\%$ B

$g = 0{,}05$: $a_1 \cdot \frac{1}{1-k} = \frac{10.000}{1{,}08} \cdot \frac{1}{1 - 1{,}05/1{,}08} = \frac{10.000}{0{,}08 - 0{,}05} \simeq 333333$

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**3.**

0 1 2 3 ...

$130'$ $\quad 130' \cdot 1{,}10 \quad 130' \cdot 1{,}10^2$

$$\text{Nåverdi: } \frac{130.000}{1{,}08} + \frac{130.000 \cdot 1{,}10}{1{,}08^2} + \ldots$$

konvergerer ikke siden $k = \frac{1{,}10}{1{,}08} > 1$

$$= \frac{130.000}{1{,}08} \cdot \frac{1}{1 - \frac{1{,}10}{1{,}08}} = \frac{130.000}{0{,}08 - 0{,}10}$$

Nåverdi $= \infty$

D

**5.**

$$x^3 - 3x^2 + 4x = 2$$

$$x^3 - 3x^2 + 4x - 2 = 0 \qquad x = \pm 1, \pm 2 \text{ mulige heltallsløsn.}$$

$x = 1$: $0 = 0$ ok.

polydiv.

$$x^3 - 3x^2 + 4x - 2 = (x-1) \cdot (x^2 - 2x + 2) = 0$$

$x = 1$ eller $x^2 - 2x + 2 = 0$

$$x = \frac{2 \pm \sqrt{4 - 8}}{2} \quad \text{ingen løsn.}$$

$x = 1$ eneste løsn.

A

~~6.~~

$$\frac{3x - 13}{4 + \sqrt{x}} = 2$$

$$3x - 13 = 2 \cdot (4 + \sqrt{x}) = 8 + 2\sqrt{x}$$

$$3x - 21 = 2\sqrt{x}$$

$$(3x - 21)^2 = 4x$$

$$9x^2 - 30x + 25 = 4x$$

$$9x^2 - 34x + 25 = 0$$

$$x = \frac{34 \pm \sqrt{34^2 - 4 \cdot 9 \cdot 25}}{2 \cdot 9} = \frac{34 \pm 16}{18} = 1, \ \frac{50}{18} = \frac{25}{9}$$

$x = 1$ eller $x = 25/9$

Setter prøve: (før kvadrering)

$x = 1$: $VS = -2$ $HS = 2$ feil

$x = \frac{25}{9}$: $VS = \frac{25}{3} - 5 = \frac{10}{3}$, $HS = 2 \cdot 5/3 = 10/3$ ok

$x = \frac{25}{9}$ eneste løsn.

D

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6. $$\frac{3x-13}{4+\sqrt{x}} = 2$$

$$3x-13 = 2(4+\sqrt{x}) = 8+2\sqrt{x}$$

$$3x-21 = 2\sqrt{x}$$

$$(3x-21)^2 = 4x$$

$$9x^2-126x+441 = 4x$$

$$9x^2-130x+441=0$$

$$x = \frac{130 \pm \sqrt{130^2-4\cdot 9\cdot 441}}{2\cdot 9}$$

$$= \frac{130 \pm \sqrt{1024}}{18} = \frac{130 \pm 32}{18}$$

$\underline{x = 9}$ eller $x = \underline{\frac{49}{9}}$

Prøve: $3x-21 = 2\sqrt{x}$

$\underline{\underline{x=9}}$ eneste løsn.

D

$x=9$: VS: $3\cdot 9-21 = \underline{6}$
HS: $2\sqrt{9} = 2\cdot 3 = \underline{6}$ ok.

$x=\frac{49}{9}$: VS: $\frac{49}{9}\cdot 3-21 = \frac{49}{3} - \frac{63}{3} = \underline{-\frac{14}{3}}$
HS: $2\sqrt{\frac{49}{9}} = \frac{2\cdot 7}{3} = \underline{\frac{14}{3}}$ falsk.

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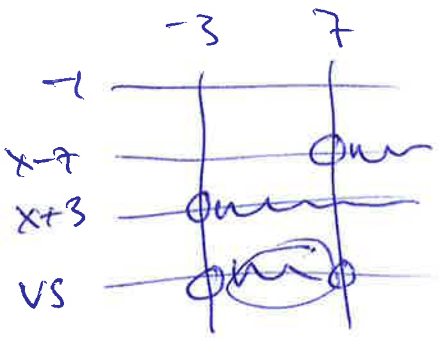
7. $20 + 4x - x^2 > -1$

$-x^2 + 4x + 21 = 0$

$x = \frac{-4 \pm \sqrt{16+84}}{-2} = 2 \pm \frac{10}{2} = 7, -3$

$-x^2 + 4x + 21 > 0$

$-(x-7)(x+3) > 0$




Løsn: $(-3, 7)$

$x > 0$: $x < 7$

B

8. $f = x^4 - 4x^2 + 3 = 0$

$x^2 = \frac{4 \pm \sqrt{16 - 4 \cdot 3}}{2} = \frac{4 \pm 2}{2} = 3, 1$

$x^2 = 3$ eller $x^2 = 1$

$x = \pm\sqrt{3}$ $\quad x = \pm 1$

$x_1 x_2 x_3 x_4 = \sqrt{3}(-\sqrt{3}) \cdot 1 \cdot (-1) = 3$

D

9. $f = \frac{x^2 - 6x + 8}{x^3 - x}$

Vertikale as:

$x^3 - x = 0$

$x(x^2 - 1) = 0$

$x = 0,\ x = 1,\ x = -1$

teller $\neq 0$ i $x = 0, \pm 1$

$\Downarrow$

3 vertikale

$x_1 = 0,\ x_2 = 1,\ x_3 = -1$

$a_1 + a_2 + a_3 = 0 + 1 - 1 = 0$

Horisontale as:

$\frac{x^2 - 6x + 8}{x^3 - x} = 0 + \frac{x^2 - 6x + 8}{x^3 - x}$

$y = 0$

$b = 0$

$a_1 + a_2 + a_3 = b$

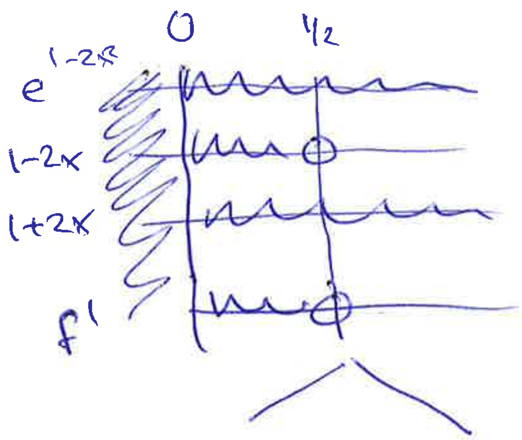
A

**10.**

$f = x e^{1-2x^2}$, $x \geq 0$

$f' = 1\cdot e^{1-2x^2} + x\cdot e^{1-2x^2}\cdot(-4x)$

$= (1-4x^2)e^{1-2x^2} = (1-2x)(1+2x)\cdot e^{1-2x^2}$




voksende i $[0, 1/2]$

avtagende i $[1/2, \rightarrow)$

C

**11.**

$f = 3x^2 \ln(x^2+x+1)$

$f' = 6x\cdot\ln(x^2+x+1) + 3x^2\cdot\frac{1}{x^2+x+1}\cdot(2x+1)$

$f'(1) = 6\cdot\ln(3) + \cancel{3}\cdot\frac{1}{\cancel{3}}\cdot 3 = \underline{6\ln 3 + 3}$

D

**12.**

$El_p D(p) = \frac{p}{D(p)}\cdot D'(p)$

$= \frac{p}{\frac{2}{p^2}-\frac{3}{p^3}}\cdot\left(2p^{-2}-3p^{-3}\right)' = \frac{p\cdot\left(-4p^{-3}+9p^{-4}\right)}{\frac{2}{p^2}-\frac{3}{p^3}}$

$= \frac{-\frac{4}{p^2}+\frac{9}{p^3}}{\frac{2}{p^2}-\frac{3}{p^3}}\cdot\frac{p^3}{p^3} = \frac{-4p+9}{2p-3} = -1$

$-4p+9 = -(2p-3)$

$-4p+2p = 3-9$

$-2p = -6$

$\underline{p=3}$

C

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13. $\lim_{x\to 1} \frac{\ln x}{x^2-4x+3} \underset{\text{"}\frac{0}{0}\text{"}}{=} \lim_{x\to 1} \frac{1/x}{2x-4} = \frac{1}{-2} = -\frac{1}{2}$ (D)

14. $f = (1-x)\sqrt{x^2+1}$

$f' = -1\cdot\sqrt{x^2+1} + (1-x)\cdot\frac{1}{\cancel{2}\sqrt{x^2+1}}\cdot\cancel{2}x$

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

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

$-2x^2+x-1=0$

$x = \frac{-1\pm\sqrt{1-9}}{-4}$

ingen løsn.

$\Downarrow$

$-2x^2+x-1$ neg. for alle $x$

$f'(x) < 0$ for alle $x$

ingen max/min (A)

15. $f = x\cdot e^{x^2-1}$

$f' = 1\cdot e^{x^2-1} + x\cdot e^{x^2-1}\cdot 2x = (1+2x^2)e^{x^2-1}$

$f'' = 4x\cdot e^{x^2-1} + (1+2x^2)e^{x^2-1}\cdot(2x)$

$= [4x+2x(1+2x^2)]e^{x^2-1} = 2x(2+1+2x^2)e^{x^2-1} = 2x(3+2x^2)e^{x^2-1}$

~~Vendepkt: $x=0$, $x=\pm\sqrt{1/2}$~~

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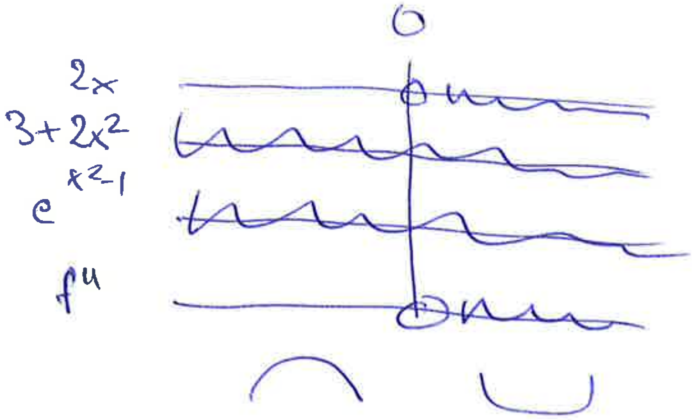
$$f''(x) = 2x\,(3+2x^2)\,e^{x^2-1}$$




Vendepkt:

$\underline{x=0}$

C