First name:

Last name:

SID number:

Instructions: Write your name and SID number above; circle your answer below, *and* fill out the same answer on the bubble sheet (as well as SID number and name).

Problem 1. A quantity of 100 increases by 4% per year (with annual compounding). After 4 years the quantity has increased to approximately what?
(a) 117
(b) 90
(c) 10
(d) 2170

Problem 2. If $a > b$, which of these inequalities *must* be true?
(a) $-a > a$
(b) $(-b)^2 > -ab$
(c) $b - a^2 < 0$
(d) none of the above

Problem 3. Let $S = \sum_{i=1}^{3}(i-1)^2$. Then S equals:
(a) 1
(b) 5
(c) 19
(d) none of the above

Problem 4. The graph of the linear function $f(x)$ passes through the points $(x_1, y_1) = (\alpha, 1 + \alpha)$ and $(x_2, y_2) = (1, \frac{\alpha^2+1}{\alpha})$. Which is the function?
(a) $f(x) = \alpha + 1$
(b) $f(x) = \alpha + \alpha/x$
(c) $f(x) = \alpha + x/\alpha$
(d) none of the above

Problem 5. Let $f(x) = x^a - x$, where $a \neq 0$. Which of the below gives a quadratic approximation of $f(x)$ about $x = 1$?[1]
(a) $(x-1)(a-1)\left(1 + \frac{a(x-1)}{2}\right)$
(b) $ax^{a-1}(x-a) + (a-1)ax^{a-2}(x-a)^2$
(c) $(a-1)(x-1)$
(d) none of the above

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[1]Recall that a quadratic approximation of $f(x)$ about $x = b$ is given by $f(b) + f'(b)[x-b] + \frac{f''(b)}{2}[x-b]^2$.

Problem 6: Let $\overline{Y} = [\alpha K^\rho + (1 - \alpha)L^\rho]^{\frac{1}{\rho}}$, where $\overline{Y}$ is a constant. Which one of the below options gives $\frac{dK}{dL}$?

(a) $\left(\frac{1}{\rho}\right)[\alpha K^\rho + (1 - \alpha)L^\rho]^{\frac{1}{\rho}-1}(1 - \alpha)\rho L^{\rho-1}$

(b) $\alpha\rho K^{\rho-1} + (1 - \alpha)\rho L^{\rho-1}$

(c) $-\left(\frac{1-\alpha}{\alpha}\right)\left(\frac{K}{L}\right)^{1-\rho}$

(d) none of the above

Problem 7: Let $f(x) = \frac{\ln x}{1-x}$. Which of the below gives the first derivate of $f(x)$?

(a) $f'(x) = \frac{1}{(1-x)^2}\left(\frac{1-x}{x} + \ln x\right)$

(b) $f'(x) = \frac{1}{x(1-x)}$

(c) $f'(x) = \frac{-\ln x}{(1-x)^2}$

(d) none of the above

Problem 8: Let $U(C) = -e^{-\gamma C}$, where $\gamma > 0$ is a constant, and $R(C) = \frac{-U''(C)C}{U'(C)}$. Which of the panels in Figure 1 shows the graph of R? (The diagrams all have C on the horizontal axis.)
(a) Panel A
(b) Panel B
(c) Panel C
(d) Panel D

Problem 9: Let $Z(t) = 1 - e^{-at}$, where $a > 0$ is a constant Which one of the below options gives $\lim_{t\to\infty} Z(t)$?
(a) $1 - ae^a$
(b) a
(c) 1
(d) none of the above

Problem 10: Let $f(x) = (x - 1)/[e^{\gamma(x-1)} - 1]$, where $\gamma \neq 0$ is a constant. Which one of the below options gives a $\lim_{x\to1} f(x)$?
(a) $e^{-\gamma}$
(b) $1/\gamma$
(c) 0
(d) none of the above

Figure 1: Panel A

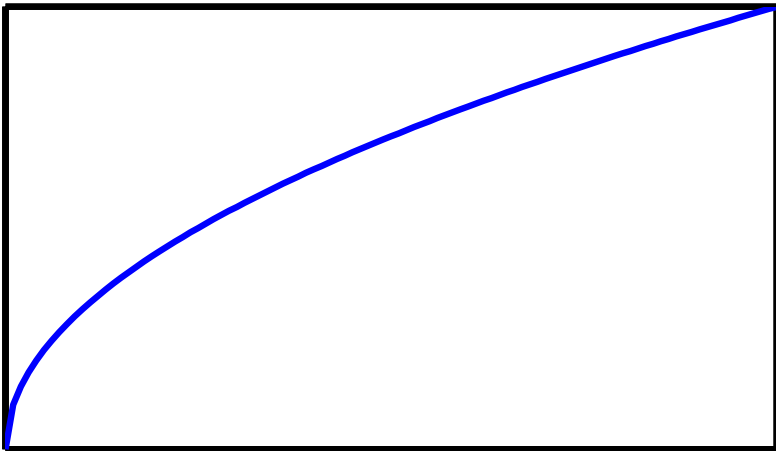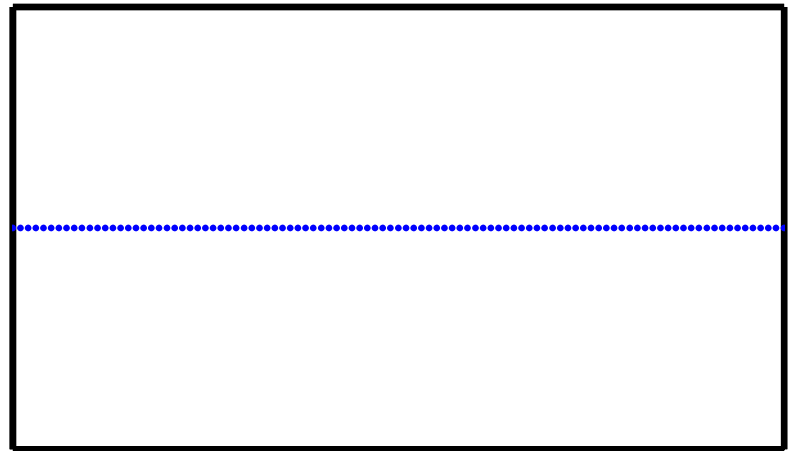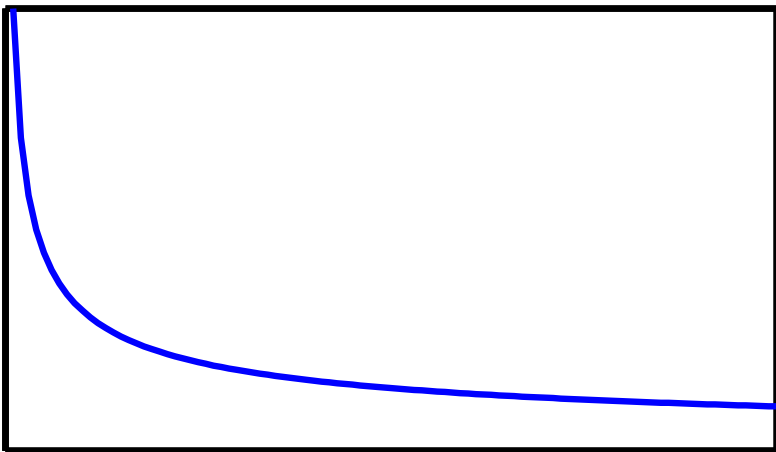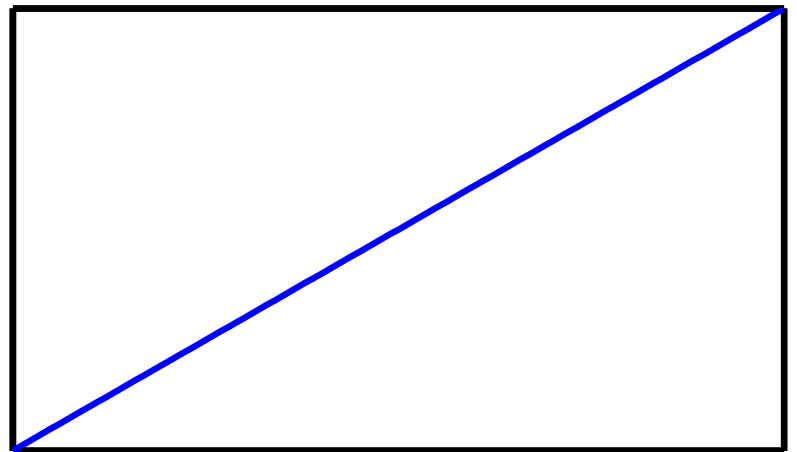## Figure 1: Panel B

Figure 1: Panel C

Figure 1: Panel D

Solutions
Problem 1: (a)
Problem 2: (d); For any $a > 0$ we can rule out (a); for $a = 2 > b = -1$ we can rule out (b);
for $a = 1/3 > b = 1/4$ we can rule out (c)
Problem 3: (b)
Problem 4: (c)
Problem 5: (a)
Problem 6: (c)
Problem 7: (a)
Problem 8: (d)
Problem 9: (c)
Problem 10: (b)