BECA / Dr. Huson / IB Math SL
11 January 2018
Test: Regents exponents problems

Name:

Free Response Questions

11. Write $\sqrt[3]{x} \cdot \sqrt{x}$ as a single term with a rational exponent. (2)

$x^{\frac{1}{3}} \cdot x^{\frac{1}{2}} = x^{\frac{5}{6}}$

12. Explain how $(8^{\frac{1}{9}})$ can be written as the equivalent radical expression $\sqrt[3]{2}$ (2)

$8^{\frac{1}{9}} = \left(8^{\frac{1}{3}}\right)^{\frac{1}{3}} = 2^{\frac{1}{3}} = \sqrt[3]{2}$

the 1/9 exponent can be factored and expressed as a power of a power, $\frac{1}{3} \cdot \frac{1}{3}$. Two is substituted as $8^{1/3}$. The 3 in the denominator of the exponent of 2 can be expressed as the index of a radical, a cube root of 2.

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13. Algebraically determine the values of h and k to correctly complete the identity stated below.

$$2x^3 - 10x^2 + 11x - 7 = (x-4)(2x^2 + hx + 3) + k$$

(2)

$$= 2x^3 + hx^2 + 3x + k$$
$$- 8x^2 - 4hx - 12$$
$$= 2x^3 + (h-8)x^2 + (3 - 4h)x + (k-12)$$

$\uparrow -10$ $\quad \uparrow 11$ $\quad \uparrow -7$

$h - 8 = -10$
$h = -2$
$k - 12 = -7$
$k = 5$

14. Given the exponential function $f(x) = 17e^{(0.15x)}$.

(4)

(a) Write down $f(0)$. 17

1

(b) Find $f(2)$. $= 17e^{(0.15 \cdot 2)} = 22.947599\ldots \approx 22.9$

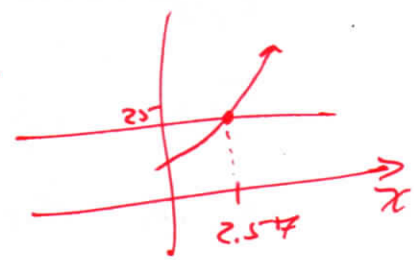
1

(c) Solve for x such that $f(x) = 25$.

2

$17e^{0.15 \cdot x} = 25$
$0.15x = \ln\left(\frac{25}{17}\right)$
$x = ~~2.33734\ldots \approx~~ 2.34$
$2.57108\ldots \approx 2.57$

or



15. Express $(1-i)^3$ in $a + bi$ form.

(2)

$= 1 - 3i + 3i^2 - i^3$
$= 1 - 3i - 3 + i$
$= -2 - 2i$

17.

Using the formula below, determine the monthly payment on a 5-year car loan with a monthly percentage rate of 0.625% for a car with an original cost of \$21,000 and a \$1000 down payment, to the *nearest cent*.

(6)

$$P_n = PMT\left(\frac{1-(1+i)^{-n}}{i}\right)$$

(3)

P_n = present amount borrowed $21,000 - 1000 = 20,000$

n = number of monthly pay periods 60

PMT = monthly payment

i = interest rate per month 0.625%

$$PMT = P_n \Big/ \left(\frac{1-(1-i)^{-n}}{i}\right)$$

$$= 20,000 \cdot \frac{0.625\%}{(1-(1.00625^{-60})}$$

$$= \$418.07$$

The affordable monthly payment is \$300 for the same time period. Determine an appropriate (3) down payment, to the *nearest dollar*.

$$P_n = 300\left(\frac{1-(1+0.00625)^{-60}}{0.00625}\right)$$

$$= 14,971.59$$

$$21,000 - 14,971.59 = 6028.41$$

$$\approx \$6028$$

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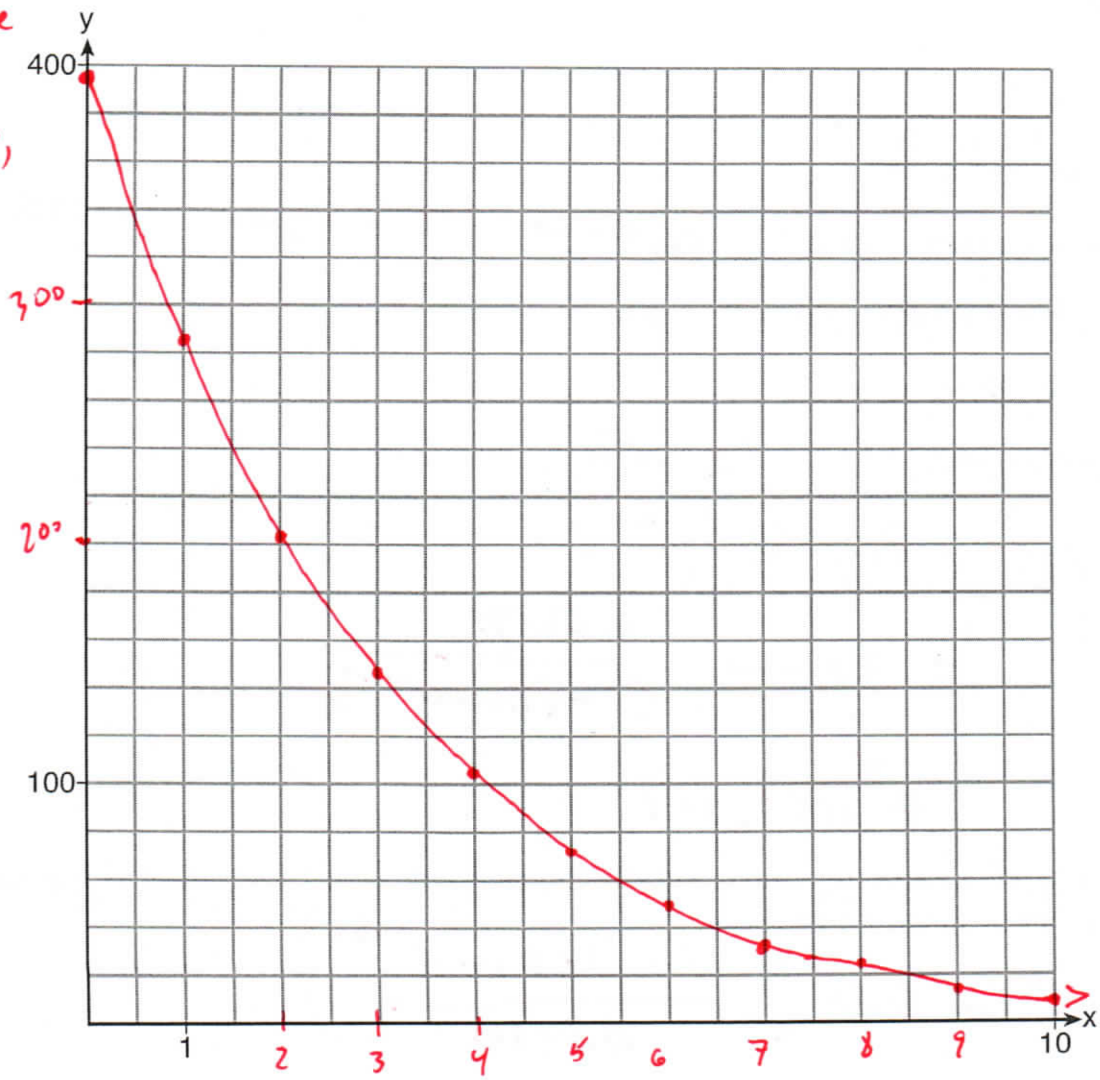
16.

Graph $y = 400(.85)^{2x} - 6$ on the set of axes below.

(4)

Note: the y-intercept is not 400, it's 394



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18.

Jim is looking to buy a vacation home for \$172,600 near his favorite southern beach. The formula to compute a mortgage payment, M, is $M = P \bullet \frac{r(1+r)^N}{(1+r)^N - 1}$ where P is the principal amount of the loan, r is the monthly interest rate, and N is the number of monthly payments. Jim's bank offers a monthly interest rate of 0.305% for a 15-year mortgage. (6)

180 months

With no down payment, determine Jim's mortgage payment, rounded to the *nearest dollar*. (3)

$$M = 172{,}600 \cdot \frac{0.00305(1+0.00305)^{(15\cdot 12)}}{(1+0.00305)^{15\cdot 12}-1}$$

$$= \$1247.49$$

$$\approx \$1247$$

Algebraically determine and state the down payment, rounded to the *nearest dollar*, that Jim needs to make in order for his mortgage payment to be \$1100. (3)

$$1100 = \cancel{172{,}600}\ P \cdot \frac{0.00305(1+0.00305)^{180}}{1.00305^{180}-1}$$

$$P = 1100 \cdot \frac{1.00305^{180}-1}{0.00305(1+0.00305^{180})}$$

$$= 152{,}193.19$$

Down payment $= 172{,}600 - 152{,}193.19$

$$= 20{,}406.80$$

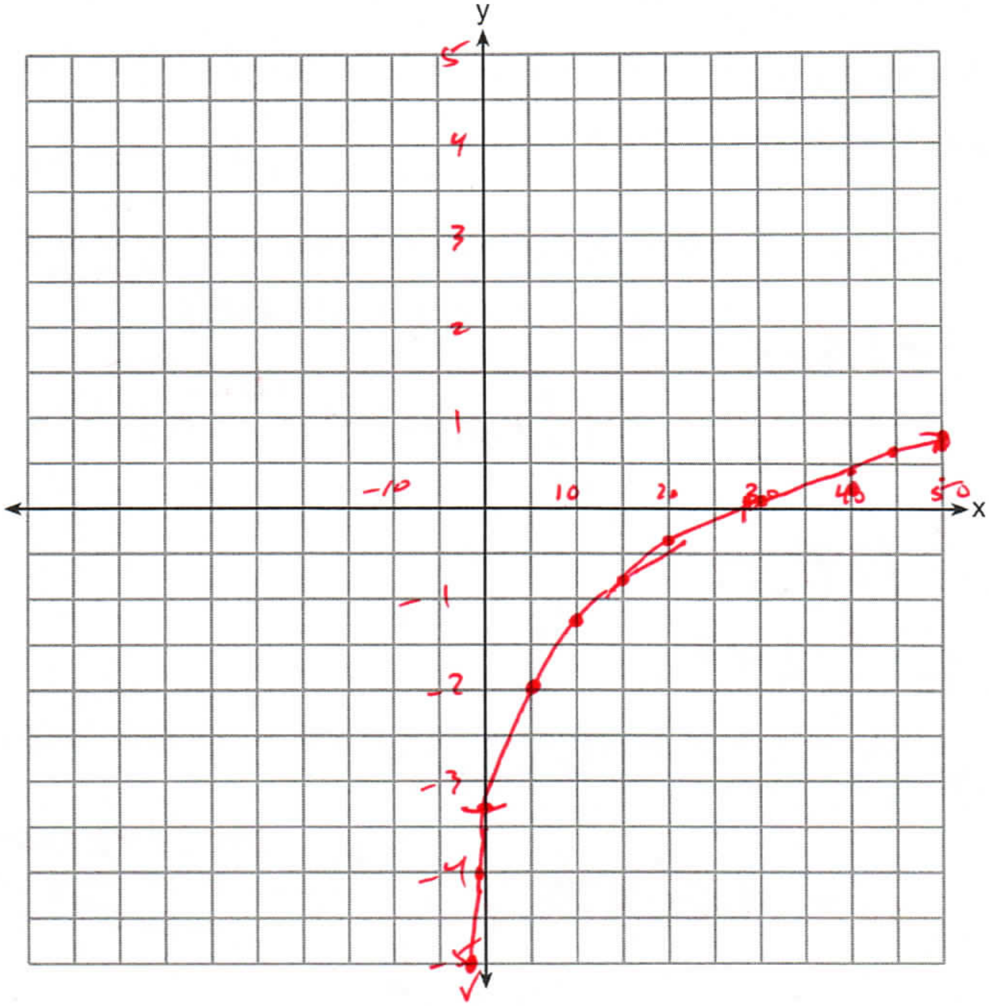
$$\approx \$20{,}407$$

(6)

19.

Graph $y = \log_2(x + 3) - 5$ on the set of axes below. Use an appropriate scale to include *both* intercepts.

(4)



x	y
0	-3.415
29	0

Describe the behavior of the given function as x approaches -3 and as x approaches positive infinity. (2)

As x approaches -3, y goes to negative infinity.
As x approaches positive infinity, y grows without ~~b~~ bound.