

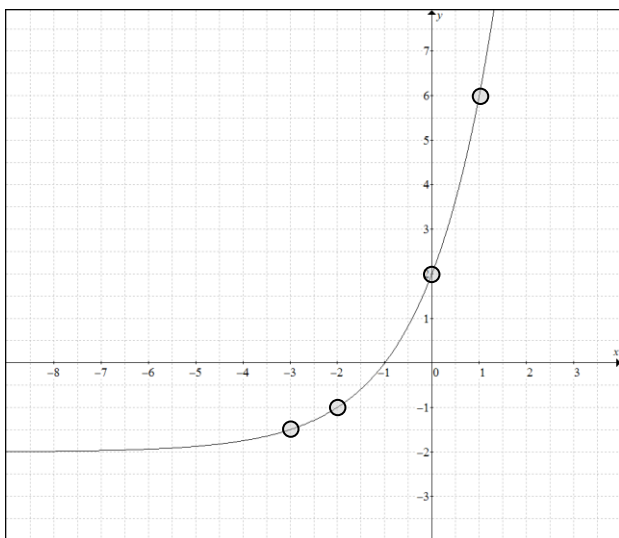
- 1) Given the following function $f(x) = 2(x-1)(x+2)(x+1)^2$,
- Determine the intercepts;
 - State the degree of the function;
 - Sketch the graph;
 - Describe the roots of graph.
- 2) Use the indicated division method to perform the following divisions and express your answers in the form $f(x) = d(x)q(x) + r(x)$
- a) $(3x^3 - 11x^2 - 7 + 21x) \div (-2 + 3x)$
(long division)
- b) $(6x^5 - 3x^3 + 7x^2 + 4) \div (x + 1)$
(synthetic division)
- 3) If -2 is one root of $x^2 + kx - 6 = 0$, find the **other root** and the **value of k**.
- 4) $f(x) = x^3 + kx^2 + hx + 12$. When $f(x)$ is divided by $x - 1$, the remainder is 5. When $f(x)$ is divided by $x + 3$, the remainder is -27. Find the values of k and h.
- 5) Solve $x^3 - x^2 - x - 15 = 0$, $x \in C$
- 6) Solve $2x^3 + 3x^2 - 18x - 5 = 0$, $x \in C$
- 7) Solve $8(x - x^2) = -12 - (x^2 - x)^2$ for x . $x \in C$
- 8) For the curve $y = 3\left(\frac{61}{62}\right)^x - 5$,
- there is a _____ asymptote which the equation is _____ .
 - there is an _____ - intercept, which is _____ .
 - the function is _____ (increasing, decreasing, not changing)
 - the domain is _____ .
 - the range is _____ .
- 9) Simplify. Express final answer with positive exponents.

$$\frac{(-3x^{-3}y^2)^{-4}}{-2^{-3}x^{\frac{2}{5}}y^{-1}}$$

Name: _____

10) A culture has 750 bacteria. The number of bacteria doubles every 5.25 hours. How many bacteria (to the nearest hundred) are in the culture after 18.15 hours?

11) Write an exponential function for the following graph:



12) In eight days a certain amount of Vanadium-48, V^{48} , decays to $\frac{1}{\sqrt{2}}$ of its original amount. What is the half-life of V^{48} ?

13) In 1947 an investor bought Van Gogh's painting *Irises* for \$84 000. In 1987 she sold it for \$49 000 000. What annual rate of interest corresponds to an investment of \$84 000 which grows to \$49 million in 40 years? (1 decimal place)

14) For the curve $y = 4 \log_3(x - 2) + 5$

- a) there is a _____ asymptote which the equation is _____.
- b) there is a _____ - intercept, which is _____. (2 decimal places)
- c) the function is _____ (increasing, decreasing, not changing).
- d) the domain is _____.
- e) the range is _____.

15) Write $5^4 = 625$ in logarithmic form.

16) Write $\frac{2}{3} \log_a x - \frac{1}{4} \log_a y - \log_a z$ as a single logarithm.

17) If $\log 6 = m$ and $\log 5 = n$, write $\log 7.2$ as an expression in m and n .

18) Use the logarithmic properties to evaluate $\log_{\sqrt{2}} 32$.

19) Use logarithms to solve x . (2 decimal places)

a) $7^{3-x} = 4$

b) $7^{3x} = 8^{2x}$

20) If $\log_3 4 \approx 1.26$, use logarithms to find an approximation for $\log_3 \left(\frac{16}{3} \right)$. Show at least one step.

21) Solve $3 \log x = \log 512 - \log 8$

22) Determine the point of intersection of the curves $y = \log_{10}(x-2)$ and $y = 1 - \log_{10}(x+1)$

23) Evaluate each of the following by expressing in terms of a related acute angle.

a) $\tan \frac{45\pi}{4}$

b) $-\sec \frac{7\pi}{6}$

c) $\sin \left(-\frac{5\pi}{6} \right)$

d) $\csc \frac{17\pi}{4}$

24) A wheel turns 150 rev/min.

a) Find the angular velocity in radians per second.

b) What is the total distance traveled in 20 seconds if the diameter of the wheel is 90 cm.

25) A bicycle wheel has a diameter of d cm. Determine its angular velocity, in radian per second, when the bicycle travels at x km/h.

26) Determine the function for the given *cosine* graph.

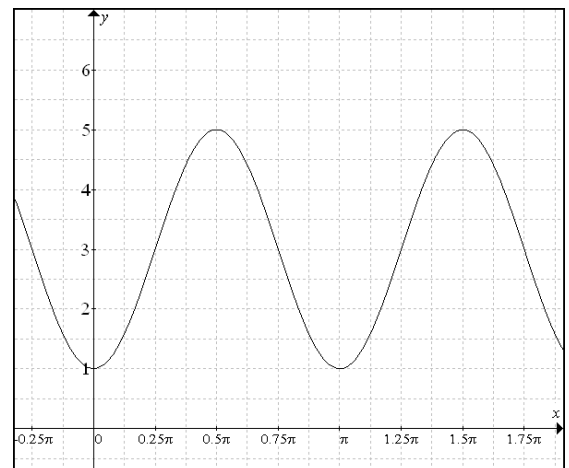
27) Convert *sin* to *cos* or *cos* to *sin* in each of the following:

a) $y = 2 \sin 4 \left(x - \frac{\pi}{8} \right)$

b) $y = \cos 3x + \pi$

28) For $y = \frac{-1}{2} \cos \left(2x - \frac{\pi}{6} \right) + 4$,

Sketch the function for $0 \leq \theta \leq 2\pi$ and highlight 1 cycle in a proper size and scale.
(State the *Amplitude*, *Period*, *Phase Shift* and *Vertical translations*)



29) When comparing the graphs of $y = \tan \theta + b$ and $y = \cot \theta + b$,

a) In what ways they are similar? (In terms of the amplitude, period, ... etc)

b) Convert the given *cotangent* function to *tangent* function with an appropriate transformation.

30a) Sketch one cycle within 2π of $y = 2 \csc 2\pi \frac{(\theta+3)}{6} + 4$

(State the *Amplitude, Period, Phase Shift* and *Vertical translations*)

b) State the domain and range.

31) Express and find the exact value of $\cot\left(\frac{-8\pi}{3}\right)$ using the correlated acute formula.

32) Simplify: $\frac{\sin\left(x - \frac{\pi}{2}\right)}{\cos(\pi - x)} + \frac{\tan\left(x - \frac{3\pi}{2}\right)}{-\tan(\pi + x)}$

33) Find the exact value of $\sin \frac{13\pi}{12}$

34) If $\sin B = \frac{1}{4}$, $\frac{\pi}{2} < B < \pi$, find the exact value of

a) $\tan 2B$

b) $\sin 3B$

35) If $\sec A = -2$, $\frac{\pi}{2} < A < \pi$, find the exact value of

a) $\cos\left(A - \frac{\pi}{4}\right)$.

b) $\cos 4A$

36) Prove the following identities.

a) $\cos x + \cos 2x + \cos 3x = \cos 2x(1 + 2 \cos x)$

b) $\frac{1 + \sin x + \cos x}{1 + \sin x - \cos x} = \cot \frac{x}{2}$

37) Simplify and state the restrictions if any.

$$\frac{a^2 - a - 2}{6a^3 - a^2 - 12a - 5} \div \frac{2a}{3a^2 - 5a} - \frac{3a + 2}{2a^2 + 11a + 5}$$

38) Sketch $y = \frac{x^3 - 1}{x^2 + 2x}$

- Simplify the function to determine if there are any holes in the graph.
- Determine the domain of the function.
- Determine if there are any vertical or horizontal or oblique asymptotes.
- Determine the behaviour of $f(x)$ near the asymptotes by creating a table of values.
- Determine if the graph crosses over its asymptote.
- Determine the x and y intercepts.
- Sketch and label the function with a proper scale.

39) Solve the following rational inequalities. State the answers in interval notations.

$$\frac{2x^2 + 5x - 25}{4 - x^2} \leq 0$$

40) At a small clothing company, the estimated average cost function for producing a new line of jeans is

$C(x) = \frac{x^2 - 4x + 20}{x}$, where x is the number of pairs of jeans produced, in thousands. $C(x)$ is measured in dollars.

- Calculate the average cost of a pair of jeans at a production level of 3000 pairs.
- Estimate the rate at which the average cost is changing at a production level of 3000 pairs of jeans.

41) If $f(x) = \sqrt{x^2 - 81}$, $g(x) = x^4$, $h(x) = \frac{1}{2x}$, $k(x) = 2 - 3x$.

- $(f \circ g)(x)$
- Domain of $(h \circ k)(x)$
- $(g \circ f)(x)$
- $(h \circ h)(x)$
- $g\left(h\left(\frac{5}{2}\right)\right)$
- Symmetry of $f^{-1} \circ f(x)$
- $k^{-1}(k(g(x)))$
- $k(x) \times h(x)$

42) If $f(x) = 4x - 3$ and $h(x) = 4x^2 - 21$, find a function g such that $f \circ g = h$.

43) If $f(x) = x^2 - 2x - 3$, where $x \in A = \{x \mid -5 \leq x \leq 2\}$, and $g(x) = 6x - 18$, where $x \in B = \{x \mid -3 \leq x \leq 9\}$, find the functions and its domain of $\frac{g(x)}{f(x)}$.

Additional Exam reviews:

Unit reviews at the end of each units in the text book

Chapter 1: P. 74 #1-18

Chapter 2: P. 140 #1-14,17,18

Chapter 3: P. 192 #1-11, 12ab,13,15,16

Chapter 4: P. 244 #1-18, 20,22,23 (plus review the trig identities worksheet #1-56)

Chapter 5: P. 300 #1-14, skip 14d,e

Chapter 6: P. 356 #1-9,11-18

Chapter 7: P. 408 #1-14, 16-17

Chapter 8: P. 472 #1,2,4-13

Optional Cumulative Chapters reviews (P.196, P. 304 & P. 476)

Answers:

- 1) i) x-int: -1,-2,1 y-int: -4 ii) 4^{th} iii) see graph below iv) 2 diff & 2 equal real roots
 2a) $f(x) = (3x-2)(x^2-3x+5)+3$ b) $f(x) = (x+1)(6x^4-6x^3+3x^2+4x-4)+8$ 3) $k = -1, x = -2$ & 3
 4) $k = -3, h = -5$ 5) $x = 3$ or $-1 \pm 2i$ 6) $x = 2.5$ or $-2 \pm \sqrt{3}$ 7) $x = -1, -2, 2, 3$ 8a) horizontal, $y = -5$ b) $y, -2$
 c) decreasing d) $x \in R$ e) $y > -5$ 9) $\frac{-8x^{58/5}}{81y^7}$ 10) Approx 8200 11) $y = 4(2^x) - 2$ 12) 16 days
 13) Approx 17.3% 14a) vertical, $x = 2$ b) $x, 2.25$ c) increasing d) $x > 2$ e) $y \in R$ 15) $\log_5 625 = 4$
 16) $\log_a \frac{x^{2/3}}{y^{1/4}z}$ 17) $2m - n$ 18) 10 19a) 2.29 b) 0 20) 1.52 21) 4 22) $(4, \log_{10} 2)$ 23a) 1
 b) $\frac{2}{\sqrt{3}}$ c) $\frac{-1}{2}$ d) $\sqrt{2}$ 24a) 5π rad/s b) 4500π cm 25) $\frac{500x}{9d}$ rad/sec 26) $y = 2\cos 2(x \pm 0.5\pi) + 3$
 27a) $2\cos 4(x \pm \frac{\pi}{4})$ b) $\sin 3(x \pm \frac{\pi}{6}) + \pi$ 28) see graph below 29b) $\cot \theta + b = -\tan(\theta \pm \frac{\pi}{2}) + b$
 30a) see graph below b) D: $x \neq 3 + 3k, k \in I$ R: $y \geq 6$ or $y \leq 2$ 31) $\frac{1}{\sqrt{3}}$ 32) $\csc^2 x$
 33) $\frac{-\sqrt{3}+1}{2\sqrt{2}}$ 34a) $\frac{-\sqrt{15}}{7}$ b) $\frac{11}{16}$ 35a) $\frac{-1+\sqrt{3}}{2\sqrt{2}}$ b) $\frac{-1}{2}$ 37) $\frac{a^2-3a-14}{2(2a+1)(a+5)}, a \neq -5, -1, -\frac{1}{2}, 0, \frac{5}{3}$
 38) VA 0 & -2, OA $y = x - 2$ x-int = 1 y-int: none, cross over $x = \frac{1}{4}$, see graph below
 39) $(-\infty, -5], (-2, 2), [2.5, \infty)$ 40a) 0.9987 b) 0.9999 41a) $\sqrt{x^8 - 81}$ b) $x \neq \frac{2}{3}$
 c) $x^4 - 162x^2 + 6561$ d) x e) $\frac{1}{625}$ f) odd g) x^4 h) $\frac{2-3x}{2x}$ 42) $g(x) = x^2 - \frac{9}{2}$
 43) $\frac{6}{x+1}, x \neq -1, -3 \leq x \leq 2$

